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September 1995

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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INTRODUCTION

This issue of *Aerospace Medicine and Biology* (NASA SP-7011) lists 225 reports, articles, and other documents recently announced in the NASA STI Database. The first issue of *Aerospace Medicine and Biology* was published in July 1964.

Accession numbers cited in this issue include:

Scientific and Technical Aerospace Reports (STAR) (N-10000 Series)	N95-26342 — N95-28677
Open Literature (A-60000 Series)	A95-82074 — A95-86771

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the publication consists of a standard bibliographic citation accompanied, in most cases, by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations include the original accession numbers from the NASA STI Database.

Seven indexes—subject, personal author, corporate source, foreign technology, contract number, report number, and accession number—are included.

A cumulative index for 1995 will be published in early 1996.

The NASA CASI price code table, addresses of organizations, and document availability information are located at the back of this issue.

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7/95

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TYPICAL REPORT CITATION AND ABSTRACT

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ACCESSION NUMBER → **N95-10863*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA. ← **CORPORATE SOURCE**

TITLE → **BIOTELEMETRY IMPLANT VOLUME AND WEIGHT IN RATS: A PILOT STUDY REPORT**

AUTHOR → CHRIS J. SOMPS May 1994 19 p ← **PUBLICATION DATE**

CONTRACT NUMBER → (Contract RTOP 545-20-01)

REPORT NUMBERS → (NASA-TM-108812; A-94059; NAS 1.15:108812) Avail: CASI HC A03/MF A01 ← **AVAILABILITY AND PRICE CODE**

This paper reports the results of a pilot study in which a 240-gram rat was implanted for 41 days with biotelemetry devices weighing a total of 36 gm (18 cc). The implanted animal showed no differences in weight gain, food and water consumption, and postnecropsy organ weights when compared to both an unoperated control animal and an animal that underwent surgery but did not receive an implant. The implanted animal also had temperature and activity rhythms similar to those reported using much smaller implants. Thus, this pilot study showed that a 240-gm rat could be implanted with biotelemetry devices weighing nearly 15 percent of body weight without significant changes in health or behavior. A larger study involving more animals and similar implant sizes is recommended. Author

TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT

NASA SPONSORED

ACCESSION NUMBER → **A95-63745*** National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL. ← **CORPORATE SOURCE**

TITLE → **THE ORIGIN AND EARLY EVOLUTION OF ISSOL**

AUTHOR → RICHARD S. YOUNG NASA. Kennedy Space Center, Cocoa Beach, FL, US ISSOL Meeting, 7th, Barcelona, Spain, July 4-9, 1993. ← **AUTHORS' AFFILIATION**

PRIMARY DOCUMENT → A95-63744 Origins of Life and Evolution of the Biosphere (ISSN 0169-6149) vol. 24, no. 2-4. June 1994 p. 83 ← **JOURNAL TITLE** ← **PUBLICATION DATE**

Copyright

This is a discussion of the beginnings of the International Society for the Study of the Origin of Life (ISSOL)—how it came to be and the people responsible for it. It will include the early meetings on the subject of the Origin of Life which led to the formation of the Society. It will discuss the genesis of the interest of NASA in such a program and how the Exobiology Program got started, leading up to the Viking Program and the early exploration of Mars. Photographs of early meetings and the scientists involved will be included. Author (Herner)

AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 405)

September 1995

51
LIFE SCIENCES (GENERAL)

A95-82075
SETUP FOR STUDYING KINETICS OF FLUORESCENCE ANISOTROPY DECAY IN BIOLOGICAL OBJECTS
A. V. AKIMOV Russian Acad of Sciences, Moscow, Russia, G. V. DEMYANOV, N. K. KUREK, S. S. MOLCHANOV, G. S. PASHCHENKO, T. I. SYREISHCHIKOVA, R. V. FEDORCHUK, and M. N. YAKIMENKO Optics and Spectroscopy (English translation of Optika i Spektroskopiya) (ISSN 0030-400X) 78, 2 February 1995 p. 225-227 refs
(BTN-95-EIX95242679361)

This paper describes an experimental setup and technique that uses an S-60 FIAN synchrotron radiation source (accelerator) for the investigation of the spatial structure of biological membranes and lipoproteins. The rotational dynamics of a fluorescent probe were studied, and the values of the fluorescence anisotropy decay time are presented. EI

A95-82587
CROP CONDITION ASSESSMENT BY SPECTRAL REFLECTANCE OF WHEAT AS INFLUENCED BY DIFFERENT IRRIGATION LEVELS
K. K. MISHRA PASCO CORP., Tokyo, Japan, N. KALRA Indian Agricultureal Research Inst., New Delhi, India, and D. K. DAS Indian Agricultural Research Inst., New Delhi, India *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 1949-1953

Growth, yield, water use and spectral response of wheat crops were studied under varying levels of water supply for which field experiments were conducted during 1986-87 and 1987-88 cropping seasons at the Indian Agricultural Research Institute farm, New Delhi, Inida, with wheat. Regression models indicated the potentiality of the spectral estimation of the leaf area index (LAI). Significant positive correlation between the dry matter and grain yield of wheat with spectral indices for the infrared-red reflectance ratio, normalized difference, transformed vegetation index and greenes were obtained with the later giving the highest coefficient of correlation among all the spectral indices. The multiple regression analysis showed that a 60 to 110 days growth period was the most sensitive stage influencing the yield of wheat. The growth and yield of wheat mediated through differential moisture regime could be assessed by measuring the spectral response of crop. Author (Herner)

A95-82590
REMOTELY SENSED CANOPY TEMPERATURES FOR SCHEDULING IRRIGATIONS IN WHEAT CROP
K. K. MISHRA PASCO CORP., Tokyo, Japan, N. KALRA PASCO CORP., Tokyo, Japan, and D. K. DAS PASCO CORP., Tokyo, Japan *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 1965-1970

During the growing seasons of 1986-87 and 1987-88, field experiments were conducted in alluvial sandy soil at the experimental farm of the Indian Agricultural Research Institute New Delhi, India, to evaluate growth, yield, soil water status and its use and the canopy environment of the wheat cultivar (HD 2285), as influenced by the application of different levels of irrigation. The results suggest that sigma stress degree days (SDD) obtained from canopy-air temperature differences (CATD) recorded during the period of vegetative growth to ripening stages could be successfully used to predict dry matter and grain yield of wheat. Application of irrigation based on midday canopy temperature (standard deviation of +/- 0.3 C), resulted in the highest water use efficiency with a saving of 6 to 10 cm of water. Scheduling irrigation to wheat could be made based on measurement of canopy temperature without reduction in yield and at the same time saving irrigation water. Author (Herner)

A95-82605
POSTURAL CONTROL OF FISH RELATED TO GRAVITY INPUT
AKIRA TAKABAYASHI Fujita Health Univ., Toyoake, Japan, SATORU WATANABE Research Inst. of Environmental Medicine, Nagoya, Japan, and SADAHARU TAKAGI Research Inst. of Environmental Medicine, Nagoya, Japan *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 2059-2063

The effects of reduced buoyancy on the behavior of goldfish were examined. The tilt angle of the dorsal light response (DLR) increased by bilateral (BL) labyrinthectomy or unilateral labyrinthectomy (UL) decreased gradually for 15 weeks, nearing the value measured before the operation. When the contrast medium for X-ray photography was injected into the swimming bladder of these adapted fish, the maximum tilt angle of the DLR increased. Especially, in UL fish, the increase of tilt angle was larger toward the operated side than toward the intact side, which resembled the response measured immediately after the operation. However, the normal fish did not demonstrate such DLR induced by the reduction of buoyancy but gravity related inputs from somatosensory organs may play a significant role in the DLR of labyrinthectomized fish and that the buoyancy caused by the swimming bladder is used effectively in the adaptational process of labyrinthectomized fish in 1G. Author (Herner)

A95-82606
EFFECTS OF HIGH-ENERGY PHOSPHATE CONTENTS AND/OR UNLOADING ON CONTRACTILE PROPERTIES OF HINDLIMB MUSCLES IN RATS
YOSHINOBU OHIRA Nat'l. Inst. Fit. Sports, Kanoya City, Japan, TORU WAKATSUKI Nat'l. Inst. Fit. Sports, Kanoya City, Japan, KATSUMI NAKAMURA Univ. Kagoshima, Kagoshima City, Japan, TETSUHIKO ASAKURA Univ. Kagoshima, Kagoshima City, Japan, KOJI IKEDA Univ. Kagoshima, Kagoshima City, Japan, TSUKASA TOMIYOSHI Univ. Kagoshima, Kagoshima City, Japan, and MASAYUKI NAKAJO Univ. Kagoshima, Kagoshima City, Japan *In* International Symposium on Space Technology and Science, 18th,

Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 2065-2070

Responses of contractile properties of soleus and extensor digitorum longus (EDL) muscles to hindlimb suspension and/or changes in the contents of high-energy phosphates were studied in rats. Depletion of high-energy phosphates in muscles was induced by feeding creatine analogue beta-guanidinopropionic acid (beta-GPA). Newly weaned male Wistar rats were fed either powered control diet or the same diet containing 1% beta-GPA for approximately 9 weeks. Then each group of rats was further divided into 3 groups. One group was hindlimb suspended for 10 days and rats in this group and cage controls were fed the original diets. However, the diet in another group was switched from either control or beta-GPA to diet containing 1% creatine for 10 days. Distribution of phosphorus compounds in skeletal muscles was determined by nuclear magnetic resonance spectroscopy in anesthetized rats. A greater reduction of phosphocreatine (PCr) content was seen in rats fed beta-GPA. The degree of the reduction of adenosine triphosphate (ATP) in these muscles was minor relative to PCr, but statistically significant. Both PCr and ATP contents were elevated in response to 10-day supplementation of creatine, even though both of them were still lower than normal levels. The registance to fatigue was significantly improved in fast-twitch EDL following beta-GPA feeding, although that was unchanged in soleus which has greater fatigue registance essentially. But it was reduced following hindlimb suspension and creatine loading. Shift from fast- to slow-type, mainly due to increased one-half relaxation time, was seen in muscles with depleted high-energy phosphates especially in EDL. Such shift was reversed by feeding creatine or by hindlimb suspension which also shifted the soleus to relatively fast-twitched type. Author (Herner)

A95-82607
EXERCISE EFFECT ON BONE REMINERALIZATION AFTER EXPERIMENTAL OSTEOPOROSIS OF TAIL SUSPENDED RAT

NORIYO KAWAI Chukyo Univ., Aichi, Japan and GENYO MITARAI Chukyo Univ., Aichi, Japan *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 2071-2076

The objective of this study was to verify the exercise effect on the bone formation during recovery phase from disused osteoporosis of hindlimbs induced in the tails of suspended rats. Male wistar rats were fed while being suspended by the hindquarter of the body with a wire attached to the tail so that the rat used only the forelimbs for movement. The X-ray densitometer taken on the 3rd and the 5th week of suspension indicated that disused osteoporosis had occurred in the unloaded bones of hindlimbs. The suspended rats then were divided into three groups, i.e. one control group and two exercise groups, of which one was exposed to high speed running and the other to low speed running. By comparing ash weight of the femur, the tibia+fibula and the humerus among these groups, it was found that only the high speed running significantly facilitated recovery from the osteoporosis. The result suggested that the speed is an important factor of the exercise effect on bone remineralization. Author (Herner)

A95-82608
INFLUENCE OF SUSPENSION WITH DENERVATION ON RAT SLOW AND FAST MUSCLES: AN ULTRASTRUCTURAL AND BIOCHEMICAL STUDY

TOSHITADA YOSHIOKA St. Marianna Univ., Kanagawa, Japan, HIROTA FUJIYA St. Marianna Univ., Kanagawa, Japan, KUNIAKI SHIMIZU St. Marianna Univ., Kanagawa, Japan, TOMOYUKI KUNISHIMA St. Marianna Univ., Kanagawa, Japan, and KATSUMASA YAMASHITA St. Marianna Univ., Kanagawa, Japan *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 2077-2081

To evaluate the influence of the sciatic nerve on the slow and fast muscles of rat hindlimbs, we examined the changes in ultrastructural and biochemical characteristics in muscle loaded by suspension with denervation. The suspension with denervation more strongly affected the extensor digitorum longus muscle than the slow soleus muscle, suggesting that neurotrophic effects and/or nerve signals maintained the fiber type and contractile properties. Numerous small cells which appeared in the suspended and denervated soleus muscle were thought to be the outcome of the splitting of fibers and cell infiltration resulting in the break-down of the structural protein of the muscle fibers. Author (Herner)

A95-82609
HORMONAL CHANGES ON RAT UNDER THE HYPERGRAVITY EXPOSURE

MASAMICHI SUDOH Jikei Univ., Tokyo, Japan, HIDEFUMI WAKI Jikei Univ., Tokyo, Japan, HISASHI SAIKI St. Marianna Univ., Kanagawa, Japan, and SACHIO IKAWA Jikei Univ., Tokyo, Japan *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 2083-2088

Twelve female Wistar rats weighing about 200g were randomized into a 1G-group of four rats exposed to no additional gravity, a 1.6G-group of four rats exposed to 1.6G of gravity, and a 3G-group of four rats exposed to 3G of gravity. During 28 days, including seven days prior to gravity loading and 21 more with gravity, changes in the rats body weight, urine volume, food intake, and water intake were measured once daily by stopping the centrifuge for about an hour. Urine samples taken during the study period were analyzed for catecholamine and electrolyte contents. On gravity loading, body weight decreased to 92% in the 1.6G-group on Day 2 and to 82% on Day 2 in the 3G-group. Body weight, however, increased gradually thereafter so that by Week 3 the difference from the 1G-group was only 6% for the 1.6G-group and 10% for the 3G-group. The urine volume increased in the 1.6G-group and decreased in the 3G-group on Days 2 and 3 of gravity loading. These trends reversed thereafter with the volume decreasing slightly in the 1.6G-group and increasing in the 3G-group. On Day 1 of gravity loading, food intake diminished to 68% in the 1.6G-group and to 78% in the 3G-group. Food intake increased gradually thereafter and on Day 12 of gravity loading there was no significant difference from the 1G-group. Water intake dropped on Day 1 of gravity loading to 62% in the 1.6G-group and to 98% in the 3G-group. By Day 3 of gravity loading, however, there was no significant difference between these and the 1G-group. Other significant results are given. Author (revised by Herner)

A95-82611
BEHAVIOR OF SPACE FROG

A. IZUMI-KUROTANI Inst. of Space and Astronautical Science, Kanagawa, Japan, M. YAMASHITA Inst. of Space and Astronautical Science, Kanagawa, Japan, Y. KAWASAKI Mitsubishi Kasei Inst. of Life Sciences, Japan, T. KUROTANI Koyoto Prefectural Univ. of Medicine, Japan, Y. MOGAMI Ochanomizu Univ., Japan, M. OKUNO Univ. of Tokyo, Japan, A. OKETA Tokyo Broadcasting System Inc., Japan, and A. SHIRAISHI Fujitu Limited, Japan *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 2097-2102

Six of Japanese tree forgs (Hyla japonica) were sent to the Russian space station MIR in December, 1990. They spent eight days in space, and their postures, movements, behaviors (including response behaviors to various external stimuli) were observed under microgravity. On orbit, floating frogs stretched four legs out and bent their bodies backward. This posture was similar to that during jumping, floating in water or under a few seconds of microgravity

on the ground. Response behaviors to the external stimuli were also observed in the same way as on the ground. Frogs on the surface of something often bent their neck backward. Experiments were carried out in the early phase (L+3 days) after arrival at MIR and repeated three days after (L+6 days) to investigate effects of learning or adaptation. Typical postures of frogs floating or staying on the surface of something wre not different between the first and second experiments. Frequency of failure to land or perch on surfaces after jumping decreased in the second experiment. This suggests a presence of adaptation to microgravity. After eight days of space flight, all the frogs were returned alive to ground. At recovery + 2 hours, frogs walked or climbed slowly, and folding of hind limbs delayed after jumping. These unsual behaviors were not observed as early as 2.5 hours after recovery. Author (Herner)

A95-82612* National Aeronautics and Space Administration, Washington, DC.
DEVELOPMENT OF THE GRAVITY-SENSING ORGANS IN THE JAPANESE RED-BELLIED NEWT, CYNOPS PYRRHOGASTER
MICHAEL L. WIEDERHOLD Univ. Texas, San Antonio, TX, US, MASAMICHI YAMASHITA Inst. Space & Astronautical Sci., Sagamihara, Japan, and MAKOTO ASASHIMA Yokohama City Univ., Yokohama, Japan *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 2103-2108 Research sponsored by NASA and VA Medical Research Funds

Pre-mated adult female newts and fertilized eggs will be flown on the International Microgravity Laboratory-2 flight, schedule for 1994. One objective of the flight will be to observe the influence of microgravity on the development of the gravity-sensing organs in the inner ear. These organs contain sensory hair cells covered by a layer of dense stones (otoliths). Gravity and linear acceleration exert forces on these masses, leading to excitation of the nerve fibers innervating the hair cells. If the production of the otoliths is regulated to reach an optimal weight, their development would be abnormal in microgravity. Ground-based control experiments are reported describing the developmental sequence in which the otoliths and their associated sensory epithelium appear and increase in size. Three-dimensional reconstruction of serial sections through the otic vesicle of newt embryos at stages 31 through 40 demonstrate the first appearance, relative position and growth of the otoliths. In adult newts, the otoconia in the utricle appear similar to mammalian otoconia, which are composed of calcite. The newt saccular otoconia are at least 99% aragonite, as is found in most aquatic species. Reports of experiments in which fertilized frog eggs were flown on a Russian Cosmos mission conclude that the utricular otolith is increased in volume, whereas the saccular otolith maintains normal size, suggesting that at least the utricular weight might be regulated. Author (Herner)

A95-82613
EFFECT OF GRAVITY ON PLANT GROWTH AND CELL WALL PROPERTIES
KAZUHIKO NISHITANI Kagoshima Univ., Kagoshima, Japan, TAKAYUKI HOSON Osaka City Univ., Osaka, Japan, SEIICHIRO KAMISAKA Osaka City Univ., Osaka, Japan, RYOICHI YAMAMOTO Tezukayama College, Nara, Japan, YOSHIO MASUDA Tezukayama College, Nara, Japan, and MASAMICHI YAMASHITA Inst. of Space and Astronautical Science, Kanagawa, Japan *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 2109-2114

In order to understand roles of gravity in plant growth and development, we compared growth rates and cell wall properties in several plant organs grown under different gravity conditions as follows: (1) simulated micro-gravity conditions produced by a three dimensional (3-D) clinostat, (2) water submergence conditions and (3) hypergravity conditions produced by centrifugal force. Growth stimulation was observed under submergence conditions. On the other hand, under hypergravity conditions, plant growth was suppressed. The wide range of gravity conditions appears to act by modifying the chemical and mechanical properties of the cell wall. Thus, the cell wall plays a leading role in the growth regulation processes in a wide spectrum of gravity conditions. Author (Herner)

A95-82614
GROWTH OF THE CELLULAR SLIME MOLD, DICTYOSTELIUM DISCOIDEUM UNDER ALTERED GRAVITY
YUKISHIGE KAWASAKI Mitsubishi-Kasei Inst. of Life Sciences, Tokyo, Japan, TAKASHI OSADA Tohoh Univ., Chiba, Japan, KENJI USUI Tohoh Univ., Chiba, Japan, and TAKESHI KIRYU Tohoh Univ., Chiba, Japan *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 2115-2119

The effect of artificial gravity on the growth of the cellular slime mold, Dictyostelium discoideum, was studied, and the following results were obtained. (1) Germination efficiency increased as gravity increased up to 3G. (2) Cell differentiation was influenced by gravity. Retardation of spore formation or reduction in the spore fraction was observed at hypergravity. (3) Slugs showed the positive geotaxis. (4) Fruiting bodies were taller at hypergravity and smaller at simulated microgravity compared at 1G. Author (Herner)

A95-82616
SURVIVAL RATES OF TERRESTRIAL ORGANISMS UNDER SIMULATED SOLAR PLANETARY ENVIRONMENTS
JUNPEI KOIKE Tokyo Inst. of Tech., Yokohama, Japan, TAIRO OSHIMA Tokyo Inst. of Tech., Yokohama, Japan, KENSEI KOBAYASHI Yokohama Univ., Yokohama, Japan, and YUKISHIGE KAWASAKI Mitsubishi-Kasei Inst. of Life, Tokyo, Japan *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 2125-2130 Research sponsored by the Ministry of Education, Japan

We have been studying the survival of some species of terrestrial microorganisms, i.e., virus, bacteria, yeast and fungi, under simulated extraterrestrial conditions. The subject is not merely of academic problems, concerning as it does scientific interests pertaining to the possible origin of life in the solar system. The environment on Mars was simulated by low temperature, high vacuum, and proton irradiation and ultraviolet irradiation under gaseous condition (CO2 95.46%, N2 2.7%, Ar 1.6%, O2 0.17%, CO 0.07%, water vapor 0.03% by using a special cryostat vehicle. After exposure to the simulated Mars conditions, the survival rates of microorganisms and the mutagenicities by protons or UV irradiation were examined. From the result, tobacco mosaic virus, spores of Bacillus subtilis, Aspergillus niger and Clostridium mangenoti and some species of coccus showed considerably high levels of survival even after proton and UV irradiation. The mutagenicities of proton and UV irradiations indicated mutation frequency of 3.6 x 10(exp -8) at 450 KeV, 1.1 x 10(exp -7) at 3.45 J/sq m of mean energy, respectively. Author (Herner)

A95-83090
PHYSICAL MECHANISMS OF MUTATION INDUCED BY LOW ENERGY ION IMPLANTATION
ZENGQUAN WEI Institute of Modern Physics, Academia Sinica, Lanzhou 730000, China, HONGMEI XIE Institute of Modern Physics, Academia Sinica, Lanzhou 730000, China, GUANGWU HAN Institute of Modern Physics, Academia Sinica, Lanzhou 730000, China, and WENJIAN LI Institute of Modern Physics, Academia Sinica, Lanzhou 730000, China Nuclear Instruments and Methods in Physics Research, Section B - Beam Interactions with Materials and Atoms (ISSN 0168-583X) vol. 95, no. 3 March 15, 1995 p. 371-378
(GTN-95-0168583X94006091-578; HTN-95-Z0081)

Physical mechanisms of mutation induced by low energy ion implantation are discussed from the point of view of direct and indirect action. In direct action the average range of 110 keV Fe-56(+) ions implanted into wheat embryo was experimentally measured to be 210 +/- 30 nm. Further, the energy deposition distribution with implantation depth was calculated with the TRIM 88 code from the measured ion concentration implanted at different depths. In indirect action, energetic secondary electrons, characteristic X-rays and thermal spikes are discussed. Author (Elsevier)

A95-83339
EFFECTS OF HYPOXIA AND HYPERCAPNIA ON THE HERING-BREUER REFLEX OF THE CONSCIOUS NEWBORN RAT
TAKAFUMI MATSUOKA McGill University, Montreal, Quebec, Canada and JACOPO MORTOLA McGill University, Montreal, Quebec, Canada Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 5-11 Research sponsored by Medical Research Council of Canada
(HTN-95-21554)

We asked whether hypoxia and hypercapnia, singly or combined, affect the lung volume-dependent ventilatory inhibition (Hering-Breuer (HB) reflex) in newborn rats. Conscious rats 2, 5, and 8 days old were breathing in a flow plethysmograph. Mean lung volume was increased by applying a negative body surface pressure of 6 or 12 cm H2O. HB reflex was quantified as the inhibitory ratio (IR) of the apnea during the inflation expiratory time TE(sub infl) to the control expiratory time te(sub c). In normoxianormocapnia (control), IR with 6 cm H2O was approximately 8-12 at all ages and approximately doubled with inflation at 12 cm H2O. In hypoxia (HPX; 10% O2) or hypercapnia HPCN; 3% CO2), IR decreased at 8 days, whereas it did not differ from the control value at 2 and 5 days. In HPX + HPCN, IR decreased at all ages. In HPX (at both 6- and 12-cm H2O inflations), in HPCN (6 cm H2O), or in HPX+HPCN (6 and 12 cm H2O), IR decreased significantly more at 8 days than at 2 days. Metabolic rate, simultaneously measured, decreased during HPX or HPX+HPCN by a similar amount at all ages. The ventilatory response to HPX or to HPCN was significantly more pronounced at 8 days than at 2 days. We conclude that, during the early postnatal development of the rat, HPX orHPCN, singly or combined, reduces the HB reflex inhibition in the oldest pups, with minimal or no effects in the youngest. These developmental differences cannot be explained by differences in metabolic drive on ventilation but are contributed to by differences in chemosensitivity. Author (Herner)

A95-83340
DYNAMIC EXERCISE ENHANCES REGIONAL CEREBRAL ARTERY MEAN FLOW VELOCITY
PETER LINKIS, LISBETH G. JORGENSEN, HANNE L. OLESEN, PETER L. MADSEN, NIELS A. LASSEN, and NIELS H. SECHER Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 12-16 Research sponsored by Danish National Research Foundation
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Anterior (ACA) and middle (MCA) cerebral artery mean flow velocities V(sub mean) and pulsatility indexes were determined using transcranial Doppler in 14 subjects during dynamic exercise after assessment of the carbon dioxide reactivity for both arteries. Right hand contractions provoked an elevation in left MCA V(sub mean), whereas the pulsatility decreased in all four arteries. During right foot movement, left ACA V(sub mean) increased by 23% with lesser increases in the other arteries, and pulsatility index decreased. During cycling, ACA and MCA V(sub mean) increased bilaterally by 23% (10 - 49) and 18% (5 - 32), respectively, and the pulsatility was also elevated. Cerebral artery pulsatility did not demonstrate a focal response but depended on the muscle mass involved during exercise. The data demonstrate a significant increase in V(sub mean) for the artery supplying the cortical projection of the exercising limb. Insignificant and marginally significant increases in V(sub mean) may be related to sympathetically mediated vasoconstriction and/or coactivation of untargeted muscle groups. Author (Herner)

A95-83341
TIME COURSE FOR EXERCISE-INDUCED ALTERATIONS IN INSULIN ACTION AND GLUCOSE TOLERANCE IN MIDDLE-AGED PEOPLE
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The purposes of this study were (1) to investigate glucose tolerance and insulin action immediately after exercise and (2) to determine how long the improved glucose homeostatic mechanisms observed 12-16 h after exercise persist. Nine (seven men, two women) moderately trained middle-aged subjects performed 45 min of exercise at 73 +/- 2% of peak O2 uptake for 5 days, followed by 7 days of inactivity. Oral glucose tolerance tests (OGTT; 75g) were performed immediately postexercise (IPE) after the final exercise bout and 1, 3, 5, and 7 days after exercise. The incremental area under the plasma glucose curve was markedly higher IPE compared with those on days 1 and 3. The glucose area was significantly higher on days 5 and 7 compared with those on days 1 and 3. The incremental insulin area IPE was 43% higher compared with that on day 1 and 66% higher compared with that on day 3. The insulin area increased to 3,616 +/- 617 micr U/mml/min after 5 days of inactivity. An additional 48 h of inactivity did not result in any further increase in the plasma insulin response. Plasma free fatty acid concentrations were markedly higher before the OGTT performed IPE compared with those on day 1 and remained higher IPE at the conclusion of the OGTT. These data show an exaggerated insulin response and a marked impairment of insulin action immediately after exercise. This transient insulin resistance, which is associated with elevated plasma free fatty acid concentrations, is replaced within 24 h by enhanced insulin action and a reduced insulin response. The improved insulin action and glucose tolerance after exercise persist for 3 days but not for 5 days. Author (Herner)

A95-83342
MODEL FOR A PUMP THAT DRIVES CIRCULATION OF PLEURAL FLUID
J. P. BUTLER, J. HUANG, S. H. LORING, S. J. LAI-FOOK, P. M. WANG, and T. A. WILSON Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 23-29
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(HTN-95-21557)

Physical and mathematical models were used to study a mechanism that could maintain the layer of pleural fluid that covers the surface of the lung. The pleural space was modeled as a thin layer of viscous fluid lying between a membrane carrying tension (T), representing the lung, and a rigid wall, representing the chest wall. Flow of the fluid was driven by sliding between the membrane and the wall. The physical model consisted of a cylindrical balloon with strings stretched along its surface. When the balloon was inflated inside a vertical cylinder containing a viscous fluid, the strings formed narrow vertical channels between broad regions in which the balloon pressed against the outer cylinder. The channels simulated the pleural space in the regions of lobar margins. Oscillatory rotation of the outer cylinder maintained a lubricating layer of fluid between the balloon and the cylinder. The thickness of the fluid layer (h), measured by fluorescence videomicroscopy, was larger for larger fluid viscosity (mu), larger sliding velocity (U), and smaller pressure difference (Delta P) between the layer and the channel. A mathmatical model of the flow in a horizontal section was analyzed, and numerical solutions were obtained for parameter values of mu, U, Delta P,

and T that matched those of the physical model. The computed results agreed resonably well with the experimental results. Scaling laws yield the prediction that h is approximately (T/Delta P) (mu U/T) (exp 2/3). For physiological values of the parameters, the predicted value of h is approximately 10(exp-3) cm, in good agreement with the observed thickness of the pleural space. Author (Herner)

A95-83343
MECHANICAL LOAD AFFECTS GROWTH AND MATURATION OF SKELETAL MUSCLE GRAFTS
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Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 30-37
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The purpose of our study was to determine whether the early patterns of growth and maturation of regenerating soleus muscle grafts are sensitive to alterations in mechanical load. We hypothesized that decreased and increased mechanical loading of grafts would reduce and accelerate, respectively, the rate and magnitude of growth and impair and enhance, respectively, the pattern of maturation. On day O, soleus muscles were grafted and rats were assigned to one of three groups: cage sedentary (normal load), hindlimb suspension (decreased load), or ablation of synergist muscle (increased load). From days 7 to 35, graft mass in cage-sedentary rats increased at a rate of 1.85mg. mass/day. Rates were less for grafts of ablated rats. Neonatal myosin heavy chain (MHC) in grafts reached 10 +/- 1.6% of total MHC at day 7 for cage-sedentary rats, whereas in the suspended animals it reached 11 +/- 2.4% of total MHC at day 14. At days 21 and 35, grafts from the suspended animals had a lower proportion of slow MHC than did grafts from the control and ablated groups. Decreased mechanical load impaired the rate and degree of growth and maturation during regeneration, whereas increased mechanical load enhanced growth characteristics but not maturation. Author (Herner)

A95-83344
RESPONSES OF RAT MESENTERIC ARTERIES TO NOREPINEPHRINE DURING EXPOSURE TO HEAT STRESS AND ACIDOSIS
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Both cardiovascular abnormalities and metabolic acidosis can be prominent in heat stroke and may contribute to morbitity and mortality in heat stroke victims. Thus the effects of heat stress and/or low pH on the responses of rat messenteric arteries to norepinephrine (NE)and acetylcholine (ACh) were examined. Arteries (5-7/ group) were isolated, cannulated with micro-pippettes, placed under constant intraluminal pressure (50 mm Hg), and then examined during 60-min exposures to either (1) 37, 42, or 43 C or (2) 37 or 42 C under conditions of low pH (pH = 7.0 by addition of 1 N HCl). Contractile responses to NE remained unadulterated during exposure to 42 and 43 C. When arteries were returned from that elevated temperature back to 37 C for 30 min, enhanced contractile responses to NE were observed. Exposure to low pH depressed contractile responses to NE to a similar extent in arteries tested at 37 or 42 C. Dilations to ACh were not altered by exposure to 42 C, regardless of pH conditions, but were progressively reduced during the 43 C exposure. Arteries exposed to NE demonstrated vasomotion. The NE-induced vasomotion, while maintained at 37 C, was reduced by exposure to 43 C. In conclusion, the contractile response to NE in mesenteric arteries was not altered by heat stress per se (up to 43 C) but was depressed by low pH. The latter response was not potentiated by heat stress. Also, in mesenteric arteries, vasomotion induced by NE can be reduced by heat stress. Author (Herner)

A95-83345
STABILITY OF GLUT-1 AND GLUT-4 EXPRESSION IN PERFUSED RAT MUSCLE STIMULATED BY INSULIN AND EXERCISE
X. X. HAN, A. HANDBERG, L. N. PETERSEN, T. PLOUG, and H. GALBO Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 46-52 Research sponsored by Danish National Research Foundation, Danish Medical Research Council, the NOVO Fnd., Danish Diabetes Assn., and Weimann Fnd.
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(HTN-95-21560) Copyright

In vivo exercise and insulin may change the concentrations of GLUT-4 protein and mRNA in muscle. We studied in vitro whether adaptations in glucose transporter expression are initiated during a single prolonged period of contractions or during insulin stimulation. Rat hindquarters were perfused at 7 mM glucose for 2h with or without insulin while the sciatic nerve of one leg was stimulated to produce repeated tetanic contractions. During electric stimulation, contraction force decreased 93 +/- 1% and muscle glycogen was markedly diminished. Both contractions and insulin markedly increased glucose transport and uptake. At the end of contractions, glycogen was higher in the presence of than in the absence of insulin. In nonstimulated muscle, glucose transporter mRNA and protein concentrations were higher in the soleus than in the white gastrocnemius. These concentrations were not changed by contractions or insulin. In conclusion, GLUT-1 and GLUT-4 mRNA and protein levels are higher in slow-twitch oxidative than in fast-twitch glycolytic fibers. In vitro neither a prolonged period of exhaustive contractions per se nor maximum insulin changes glucose transporter expression in muscle during stimulation. Finally, insulin decreases net glycogen breakdown in contracting muscle.
Author (Herner)

A95-83346
EXHALED NITRIC OXIDE IN ISOLATED PIG LUNGS
GEORGE CREMONA, TIM HIGENBOTTAM, MOTOSHI TAKAO, LESLIE HALL, and EDWARD A. BOWER Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 59-63
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Endothelium-derived nitric oxide (NO) is an important regulator of vascular resistance. Low concentrations of NO have been recorded in the exhaled breath of spontaneously breathing animals and humans. To determine whether NO synthesis in the lung contributes to the NO measured in the breath, we measured the concentration of NO in the exhaled air of isolated perfused and ventilated porcine lungs by using a chemiluminescence method. With NO-free normoxic ventilation of eight porcine lungs perfused with a Krebs-dextran and albumin perfusate, baseline exhaled NO was 5.8 +/- 1.8 parts per billion (ppb) and pulmonary vascular resistance (PVR) was 8.9 +/- 1.8 mmHg/1/min. Hypoxic ventilation caused a fall in NO to 3.6 +/- 1.8ppb and a rise in PVR to 13.6 +/- 3.6 mmHG/1/min. Vasoconstriction with the thromboxane analogue U-46619 raised PVR to 31.7 +/- 6.8 mmHg/1/min but did not decrease No levels from baseline. Subsequent addition of acetylcholine lowered PVR to 22.1 +/- 4.5 mmHg/1/min and increased exhaled NO to 7.0 +/- 2.0 ppb. Addition of a NO synthase inhibitor, N(sup G)-nitro-L-arginine methyl ester to four lungs caused a rise in PVR to 43.0 +/- 7.0 mmHG/1/min and a decrease in NO to 1.5 +/- 1.0 ppb. Addition of autologous blood to the perfusate of four lungs caused no change in PRV from baseline but decreased exhale NO to 2.7 +/- 0.5 ppb. In four lungs perfused at raised outflow pressure, interstitial edema decreased No levels from 5.3 +/- 1.2 to 0.9 +/- 0.3 ppb. We conclude that the pulmonary vascular endothelium may contribute to the NO found in exhaled air. Author (Herner)

A95-83347* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
EFFECT OF EXCESS DIETARY SALT ON CALCIUM METABOLISM AND BONE MINERAL IN A SPACEFLIGHT RAT MODEL
MEENA NAVIDI, IRA WOLINSKY, PAUL FUNG, and SARA B. ARNAUD Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 70-75
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High levels of salt promote urinary calcium (UCa) loss and have the potential to cause bone mineral deficits if intestinal Ca absorption does not compensate for these losses. To determine the effect of excess dietary salt on the osteopenia that follows skeletal unloading, we used a spaceflight model that unloads the hindlimbs of 200-g rats by tail suspension (S). Rats were studied for 2 wk on diets containing high salt (4 and 8%) and normal calcium (0.45%) and for 4 wk on diets containing 8% salt (HiNa) and 0.2% Ca (LoCa). Final body weights were 9-11% lower in S than in control rats (C) in both experiments, reflecting lower growth rates in S than in C during pair feeding. UCa represented 12% of dietary Ca on HiNA diets and was twofold higher in S than in C transiently during unloading. Net intestinal Ca absorption was consistently 11-18% lower in S than in C. Serum 1,25-dihydroxyvitamin D was unaffected by either LoCa or HiNa diets in S but was increased by LoCa and HiNa diets in C. Despite depressed intestinal Ca absoption in S and a sluggish response of the Ca endocrine system to HiNa diets, UCa loss did not appear to affect the osteopenia induced by unloading. Although any deficit in bone mineral content from HiNa diets may have been too small to detect or the duration of the study too short to manifest, there were clear differences in Ca metabolism from control levels in the response of the spaceflight model to HiNa diets, indicated by depression of intestinal Ca absorption and its regulatory hormone. Author (Herner)

A95-83348
EXERCISE TRAINING ATTENUATES THE REDUCTION IN MYOCARDIAL GLUT-4 IN DIABETIC RATS
JENNIFER L. HALL, WILLIAM L. SEXTON, and WILLIAM C. STANLEY Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 76-81
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The purpose of this study was to determine the interactive effects of 10-12 wk of streptozotocin-induced diabetes (65 mg/kg) and moderate-intensity exercise training on total myocardial GLUT-4 and GLUT-1 proteins. Sprague-Dawley rats (n = 52) were randomly divided into sedentary control (SC), exercise-trained control (ETC), sedentary diabetic (SD), exercise-trained diabetic (ETD) groups. Diabetes resulted in a 70% reduction in myocardial GLUT-4 and an 18.5% decrease in GLUT-1. Exercise training increased citrate synthase activity in the medial and long heads of the triceps brachii in both groups. Fasting blood glucose improved with training in diabetic animals. The diabetes-induced reduction in GLUT-4 was attenuated with exercise training. In contrast, training resulted in a further 25% decrease compared with SD in GLUT-1 in ETD. Exercise training had no effect on either GLUT-4 or GLUT-1 in ETC. GLUT-4 inversely correlated with fasting blood glucose. In conclusion, diabetes resulted in a 70% reduction in myocardial GLUT-4 and an 18% decrease in GLUT-1. Exercise training resulted in divergent regulation of GLUT-4 and GLUT-1 in ETD, whereas it further depressed GLUT-1 compared with SD. Author (Herner)

A95-83349
HYPOXIC EFFECTS ON EXERCISE-INDUCED DIAPHRAGMATIC FATIGUE IN NORMAL HEALTHY HUMANS
MARK A. BABCOCK, BRUCE D. JOHNSON, DAVID F. PEGELOW, OSCAR E. SUMAN, DWAYNE GRIFFIN, and JEROME A. DEMPSEY Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 82-92 Research sponsored by National Heart, Lung, and Blood Institute
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We examined the effects of hypoxia on exercise-induced diaphragmatic fatigue. Eleven subjects with a mean maximal O2 uptake of 52.4 +/- 0.7 ml/kg/min completed one normoxic (arterial O2 saturation 96-94% and one hypoxic (inspiratory O2 fraction = 0.15; arterial O2 saturation 83-77%) exercise test at 85% maximal O2 uptake to exhaustion on separate days. Supramaximal bilateral phrenic nerve stimulation (BPNS) was used to determine the pressure generation of the diaphragm pre- and postexercise at 1,10, and 20 Hz. There was increased flow limitation during hypoxic vs. normoxic exercise. There was a decrease in hypoxic exercise time. After exercise the BPNS transdiaphragmatic pressure (Pdi) was significantly reduced at 1 and 10 Hz after both exercise tests. The BPNS Pdi was recovered to control values by 60 min postnormoxic exercise. The mean percent fall in the stimulated BPNS Pdi was similar after both exercise conditions. Experiencing the same amount of diaphragm fatigue in a shorter time period in hypoxic exercise may have been due to (1) the increased expiratory flow limitation and diaphragmatic muscle work, (2) decreased O2 transport to the diaphragm, and/r (3) increased levels of circulating metabolites. Author (Herner)

A95-83350
ARTERIAL AND ARTERIOLAR CONTRIBUTIONS TO SKELETAL MUSCLE FUNCTIONAL HYPEREMIA IN SPONTANEOUSLY HYPERTENSIVE RATS
JULIA M. LASH Indiana School of Medicine, Indianapolis, IN, US Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 93-100
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During contractions of the spinotrapezius muscle in spontaneously hypertensive rats (SHR), arteriolar dilation is of normal magnitude but tissue P(O2) is significantly depressed relative to normotensive (Wistar-Kyoto (WKY)) rats. This study examined the possibility that this low P(O2) results from suppressed dilation of the upstream aterial flow. Contraction-induced changes in vascular resistances (R) and conductances (G) were calculated for upstream (Rup, Gup), microvascular (Rst, Gst), and downstream (Rdown, Gdown) vascular segments from measurements of pressure and flow in the rostral feed artery and vein. Feed arteries were smaller in SHR than in WKY rats at rest and after contractions. However, relative increases in diameter and flow were greater in SHR. In both groups, Rup and Rst decreased 60-70 and 85-90% after 2- and 8-Hz contractions, respectively. However, segmental vascular conductances increased more in SHR than in WKY rats. Therefore, upstream arterial dilation is not supressed during muscle contractions in SHR, and deficits in muscle blood flow and oxygen delivery cannot account for the abnormally low tissue P(O2) observed during muscle contractions in SHR. Author (revised by Herner)

A95-83351
EXCESS OXYGEN DELIVERY DURING MUSCLE CONTRACTIONS IN SPONTANEOUSLY HYPERTENSIVE RATS
JULIA M. LASH Indiana School of Medicine, Indianapolis, IN, US and H. GLENN BOHLEN Indiana School of Medicine, Indianapolis, IN, US Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 101-111
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These experiments determined whether a deficit in oxygen supply relative to demand could account for the sustained decrease in tissue P(O2) observed during contractions of the spinotrapezius muscle in spontaneously hypertensive rats (SHR). Relative changes in blood flow were determined from measurements of vessel diameter and red blood cell velocity. Venular hemoglobin oxygen saturation measurements were performed by using in vivo spectrophotometric techniques. The relative dilation of arteriolar vessels during contractions was as large or greater in SHR than in normotensive rats (Wistar-Kyoto), as were the increases in blood flow. Venular hemoglobin oxygen saturation was lower in the resting

muscle of the SHR than of Wistar-Kyoto rats But was higher in SHR after 4- and 8-Hz contractions. Therefore, an excess in oxygen delivery occurs relative to oxygen use during muscle contractions in SHR. The previous and current results can be reconciled by considering the possibility that oxygen exchange is limited in SHR by a decrease in anatomic or perfused capillary density, arteriovenular shunting of blood, or decreased transit time of red blood cells through exchange vessels. Author (revised by Herner)

A95-83352
ROLE OF REACTIVE O2 IN PHAGOCYTE-INDUCED HYPERMETABOLISM AND PULMONARY INJURY
ANGELO A. VLESSIS Oregon Health Sciences University, Portland, OR, US, DAGMAR BARTOS Oregon Health Sciences University, Portland, OR, US, PATRICK MULLER Oregon Health Sciences University, Portland, OR, US, and DONALD D. TRUNKEY Oregon Health Sciences University, Portland, OR, US Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 112-116
(HTN-95-21567)

Activated phagocytes possess an enormous capacity for O2 consumption via NADPH oxidase. NADPH ooxidase partially reduces O2 forming super-oxide O2(-). Host enzymes rapidly complete O2(-) reduction to H2O leaving little trace of its prior existence. Our objectives were to estimate the magnitude of the whole body phagocyte respiration and determine the contribution of NADPH-derived O2(-) to the ensuing phagocyte-induced pulmonary injury. These objectives were accomplished using specific inhibitors of NADPH oxidase, diphenyl iodonium (DPI) and di-2-thienyl iodonium (DTI). Guinea pigs received intravenous injections of DPI (3.5 mg/kg), DTI (7.5 mg/kg), or vehicle followed by phorbol myristate acetate (PMA). Phagocyte activation by PMA immediately increased whole body respiration from 13.6 to 16.1 ml O2/kg/min. DPI and DTI completely blocked the increase in respiration induced by PMA injection. Baseline respiration was unchanged by the NADPH oxidase inhibitor alone. Likewise, there was no effect on the respiration of isolated heart and kidney mitrochondria from animals receiving the inhibitor with or without PMA. DPI attenuated the pulmonary injury induced by PMA. The ratio of lung water weight to dry weight was lower and arterial P(O2) was higher in animals receiving DPI plus PMA than in those receiving PMA alone. In conclusion, phagocyte activation in vivo increased total body respiration by approximately 18%. The burst in respiration is attributed to the phagocyte respiratory burst in which NADPH oxidase partially reduces O2 to O2(-). This corresponds to a O2(-) generation rate of approximately 210 micromol/kg/min, which is a significant load for host detoxification systems. In addition, NADPH-oxidase derived O2(-) contributes to the pulmonary injury induced by phagocyte activation. Author (Herner)

A95-83353
BRONCHOMOTOR RESPONSES TO HYPOXIA AND HYPERCAPNIA IN DECEREBRATE CATS
STEVE ISCOE Queen's University, Kingston, Ontario, Canada and JOHN T. FISHER Queen's University, Kingston, Ontario, Canada Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 117-123 Research sponsored by Medical Research Council of Canada
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Decerebrate animals are often used in investigations of the control of breathing because anesthesia-induced depression of respiratory reflexes is absent. We therefore investigated the level of tone and responsiveness of airway smooth muscle in seven decerebrate, paralyzed, and ventilated cats. Specifically, we measured the changes in pulmonary resistance (RL) and dynamic pulmonary compliance (CLdyn) in response to hypoxia and hypercapnia. All cats responded to hypoxia with significant increases in RL from a mean control value of 0.0197 +/- 0.0081 (SD) cmH2O sec/ml. During inhalation of 5% CO2 in O2 RL increased significantly from a mean control value of 0.0190 +/- 0.0056 cmH2O sec/ml. Decreases in CLdyn during hypoxia and hypercapnia were much smaller averaging -9 and -11%, respectively. After atropine was administered, average control RL fell 50%, from 0.0269 to 0.0134 cmH2O sec/ml. Hypoxic and hypercapnic gas mixtures did not affect pulmonary mechanics after atropine was administered. In three cats, oscillations of RL were synchronized to phreic activity but only at low respiratory frquencies, indicating that airway smooth muscle responded slowly to vagal input. Pentobarbital sodium, like atropine, reduced control RL in three cats. These cats lost their bronchoconstrictor response to hypercapnia but had augumented reponses to hypoxia compared with preanesthetic responses. We conclude that decerebrate cats possess resting bronchomotor tone and retain their responsiveness to hypoxia and hypercapnia. Thus the decerebrate cat is a useful model for studying the control of tracheobronchial smooth muscle. Author (Herner)

A95-83354
LUNG GROWTH IN HYPOBARIC NORMOXIA, NORMOBARIC HYPOXIA AND HYPOBARIC HYPOXIA IN GROWING RATS. 1: BIOCHEMISTRY
HARMANJATINDER S. SEKHON University of British Columbia, Vancouver, BC, Canada and WILLIAM M. THURLBECK University of British Columbia, Vancouver, BC, Canada Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 124-131
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(HTN-95-21569)

Adaptive changes in cellular and connective tissue components of the lung after chronic exposure to reduced ambient oxygen and/or pressure were studied. Four-week-old male Sprague-Dawley rats were randomly divided into five groups (n = 12 each): (1) general control, room air (GC); (2) hypobaric normoxic; (3) normobaric hypoxic; (4) hypobaric hypoxic; and (5) weight-matched control, restricted food intake (WMC; weight matched to hypobaric hypoxic animals). Lung growth (lung weight and DNA, RNA, protein, hydroxyproline, and desmosine contents) diminished in WMC compared with GC. Somatic growth decreased in hypobaric and normobaric hypoxic rats compared with GC. Lung weight; DNA, RNA, protein, hydroxyproline, and desmosine contents; and RNA/DNA, protein/DNA, and desmosine/DNA ratios increased in both hypobaric and nomobaric hypoxic rats compared with WMC. Hydroxyproline and desmosine contents and the hydroxyproline/DNA ratio were significantly higher in hypobaric than normobaric hypoxic rats. Hypobaric normoxia caused a slight somatic growth reduction, but biochemical parameters of lung growth remained unaffected. In conclusion, in growing animals, despite inhibition of lung growth due to reduced food consumption, accelerated lung growth in hypobaric or normobaric hypoxia occurs by hyperplastic and hypertrophic changes. Hypobaric normoxia does not affect lung growth, but connective tissue proteins accumulate slightly more in hypobaric hypoxia than in hypoxia alone. Author (Herner)

A95-83355
MYOCARDIAL EDEMA, LEFT VENTRICULAR FUNCTION, AND PULMONARY HYPERTENSION
KAREN L. DAVIS, UWE MEHLHORN, GLEN A. LAINE, and STEVE J. ALLEN Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 132-137
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(HTN-95-21570)

Left ventricular dysfunction has been reported in both experimentally induced and clinical pulmonary hypertension. However, the mechanism by which pulmonary hypertension causes left ventricular dysfunction is unknown. We hypothesized that acute pulmonary hypertension causes left ventricular myocardial interstitial edema and that it is this edema that causes left ventricular dysfunction. In pulmonary artery-banded or sham-operated dogs, left ventricular diameter (septal-free wall axis) and pressure were measured using sonomicrometry crystals and a micromanometer, respectively. These measurements were used to calculate preload recruitable stroke work (PRSW), an index of contractility, and the rate of active relaxation (tau) to assess systolic and diastolic left ventricular function, respectively. After 3 h of pulmonary arterial hypertension or control, the dogs were killed and the left ventricles

were excised to determine wet-to-dry weight ratios. The wet-to-dry weight ratios were significantly higher in the pulmonary artery-banded dogs (3.57 +/- 0.12) than in the sham-operated dogs (3.41 +/- 0.17). PRWS decreased to 56.8 +/- 30.3% of control after 3 h of pulmonary hypertension. Tau slowed significantly from 29.8 +/- 5,8 ms at baseline to 63.6 +/- 30.4 ms after 3 h of pulmonary arterial hypertension. There were no differences in PRSW or tau in the sham operated dogs. We conclude that pulmonary hypertension causes left ventricular myocardial interstitial edema, which results in both systolic and diastolic left ventricular dysfunction. Author (Herner)

A95-83356
ADAPTATIONS IN MUSCLE METABOLISM TO PROLONGED VOLUNTARY EXERCISE AND TRAINING

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In previous research we established using a short (5-7 days) training model that increases in muscle oxidative potential are not a prerequisite for the characteristic energy metabolic adaptations (lower lactate, glycogen depletion, and phosphocreatine hydrolysis) observed during prolonged exercise. To investigate whether increased muscle aerobic potential further potentiates the metabolic adaptive response, seven healthy male volunteers engaged in an 8-wk training program consisting of 2h of cycle exercise at 62% of pretraining dot-V(sub O2max) 5-6 times/wk. Analysis of tissue samples obtained from the vastus lateralis after 60 min of exercise revealed that by 4 wk of training muscle lactate concentration, phosphocreatine hydrolysis, and glycogen depletion were depressed. Further training for 4 wk had no additional effect. The ratio of fructose 6-phosphate to fructose 1,6-phosphate, an index of phosphofructokinase activity, was not altered with training. Muscle oxidative potential as estimated from the maximal activity of succinic dehydogenase increased by 31% by 4 wk of training before plateauing during the final 4 wk of training. The increase in dot- V(sub O2max) of 15.6% noted with training was also primarily expressed during the initial 4 wk O2 uptake during submaximal exercise was unchanged. Because the metabolic response was similar in magnitude to that previously observed with short-term training, we conclude that, at least for the conditions of this study, the development of increased muscle aerobic potential is of minimal consequence on the magnitude of the energy metabolic adaptations examined. Author (Herner)

A95-83357
IMP METABOLISM IN HUMAN SKELETAL MUSCLE AFTER EXHAUSTIVE EXERCISE

PETER C. TULLSON, JENS BANGSBO, YLVA HELLSTEN, and ERIK A. RICHTER Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 146-152
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This study addressed whether AMP deaminase (AMPD): myosin binding occurs with deamination during intense exercise in humans and the extent of purine loss from muscle during the initial minutes of recovery. Male subjects performed cycle exercise to stimulate muscle inosine 5'-monophosphate (IMP) formation. After exercise, blood flow to one leg was occluded. Muscle biopsies (vastus lateralis) were taken before and 3.6 +/- 0.2 min after exercise from the occluded leg and 0.7 +/- 0.0, 1.1 +/- 0.0, and 2.9 +/- 0.1 min postexercise in the nonoccluded leg. Exercise activated AMPD; at exhaustion IMP was 3.5 +/- 0.4 mmol/kg dry muscle. Before exercise, 16.0 +/- 1.6% of AMPD cosedimented with the myosine fraction; the extent of AMPD:myosin binding was unchanged by exercise. Inosine content increased about threefold during exercise and twofold more during recovery; by 2.9 min postexercise it was 0.43 +/- 0.02 mmol/kg dry muscle. IMP decreased 2.1 +/- 0.3 mmol/kg dry muscle with no change in total adenylates. Total purines declined significantly during the recovery period in the nonoccluded leg, consistent with a loss of purines to the circulation, whereas total purines were unchanged in the occluded leg. Regulation of muscle purine content is a dynamic process that must accommodate rapid changes due to degradation and efflux. Author (Herner)

A95-83358
RAT RETROTRAPEZOID NUCLEUS IONO- AND METABOTROPIC GLUTAMATE RECEPTORS AND THE CONTROL OF BREATHING

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We injected 10 nl (unilateral) of glutamate receptor antagonists or agonists into the region of the retrotrapezoid nucleus and measured the phrenic nerve and blood pressure responses. The rats were chloralose-urethan anesthetized, paralyzed, vagotomized, and ventilated, and each injection location was verified anatomically. Integrated phrenic amplitude was most reliably affected. The N-methyl-D-aspartic acid (NMDA) antagonists 2-amino-5-phosphonopentanoic acid and 6-cyano-7-nitroquinoxaline -2,3-dione (which affects both NMDA and non-NMDA receptors) both decreased baseline eucapnic phrenic amplitude and the CO2 response. Glutamate increased phrenic amplitude in a dose-dependent manner, an effect blocked by prior injection of the NMDA and non-NMDA antagonists at the same site. The response duration depended on the duration of the glutamate injection: responses to 3-s injections lasted a few minutes, and resposes to 60-s injections lasted for greater than 30 min. The long-lasting effect was reproduced by injection of the metabotropic agonist 1(S),3(R)- aminocyclopentanedicarboxylic acid at 0.01-0.02 times the glutamate dose. We conclude that the rat retrotrapezoid nucleus has an endogenous source of glutamate that maintains eucapnic phrenic output and allows expression of the CO2 response. NMDA and possibly non-NMDA receptors are involved. Their stimulation increases phrenic output via ionotropic and metabotropic receptor processes with the latter resulting in long-lasting phrenic stimulation. Author (Herner)

A95-83359
REFRACTORY CERAMIC FIBERS ACTIVATE ALVEOLAR MACROPHAGE EICOSANOID AND CYTOKINE RELEASE

GEORGE D. LEIKAUF, STEVE P. FINK, MARIAN L. MILLER, JAMES E. LOCKEY, and KEVIN E. DRISCOLL Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 164-171
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Refractory ceramic fiber has been developed for industrial processes requiring materials with high thermal and mechanical stability. To evaluate the biological activity of this fiber, rat alveolar macrophages were exposed fo less than or equal to 24 h to 0-1,000 microgram/ml of refractory ceramic fiber, crocidolite asbestos, silica (fibrogenic particless), or titanium dioxide (a nonfibrogenic particle), and eicosanoid, tumor necrosis factor-alpha (TNF), and lactate dehydrogenase release were measured. Particle dimensions were determined by electron microscopy. Radioactivity coeluting with leukotriene B(sub 4) LBT(sub 4) and immunoreactive LBT(sub 4) and TNF release increased after refractory ceramic fiber and were similar in magnitude after asbestos but less than after silica. For example, the total (H-3)eicosanoid release increased 3.9-fold after refractory ceramic fiber, 4.6-fold after asbestos and 8.7-fold after silica. Refractory ceramic fiber and asbestos also have similar particle dimensions (diameter, length, and surface area). Inasmuch as macrophage-derived LBT(sub 4) and TNF are potent mediators in inflammatory events, including migration and activation of neutrophils, these findings suggest that refractory ceramic fiber can

activate macrophages in vitro to release mediators relevant to in vivo findings of inflammation and fibrotic lung disease in laboratory animals. Author (Herner)

A95-83360
EFFECT OF AGING ON BETA(SUB 2)-ADRENERGIC RECEPTOR-STIMULATED FLUX OF K(+), PO4,FFA, AND GLYCEROL IN HUMAN FOREARMS
GARY A. FORD, WILLIAM D. DACHMAN, TERRANCE F. BLASCHKE, and BRIAN B. HOFFMAN Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 172-178 (Contract(s)/Grant(s): NIH-AG-05627; NIH-MO1-RR0070; NIH-GM-07065)
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Adrenergenic responses have been shown to decline with aging, particularly in the cardiovascular system. We infused terbutaline, a selective beta (sub 2)-adrenoceptor agonist, into the brachial artery of 10 young men (mean age 25 yr, range 22-31 yr) and 9 elderly (mean age 73 yr, range 68-81 yr) healthy subjects to examine its effects on nutrient flux. Forearm K(+), PO4, free fatty acid (FFA), and glycerol uptake were determined by measurment of forearm blood flow (using dye dilution) and brachial arterial and deep venous plasma substrate concentrations. Elderly subjects were less sensitive to terbutaline-mediated increases in forearm blood flow, net fluxes of K(+), and glycerol but not net fluxes of FFA or PO4. The mean fitted slopes of each parameter vs. the log of the terbutaline concentration, a meaure of forearm beta-adrenergic sensitivity, for young and elderly groups were 4.9 +/- 1.7 (SD) vs. 2.4 +/- 2.3 for forearm blood flow, 0.84 +/- 0.46 vs. 0.43 +/- 0.37 for K(+) net flux, -157 +/- 113 vs. - 26 +/- 26 for glycerol net flux, -336 +/- 429 vs. - 44 +/- 457 for FFA net flux, and 0.31 +/- 0.24 vs. 0.18 +/- 0.16 for PO4 net flux. Terbutaline promoted net uptake of K(+) into skeletal muscle less well in the elderly, although net PO4 flux was similar in the two groups. Terbutaline-stimulated vasodilation and net glycerol efflux but not FFA efflux were impaired with aging. These data demonstrate that heterogeneous changes in beta-adrenergic responses occur with aging. Author (Herner)

A95-83361
ROLE OF ANGIOTENSIN II IN HEMODYNAMIC RESPONSES TO DYNAMIC EXERCISE IN MINISWINE
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Angiotensin II (ANG II) is a potent vasoconstrictor of splanchnic and renal resistance vessels. Because ANG II increases during exercise and blood flow in the splanchnic and renal circulations decreases, we tested the hypothesis that ANG II plays a role in arterial blood pressure and regional blood flow responses to treadmill running in the miniswine. Consequently, 11 pigs were instrumented with epicardial electrocardiogram leads and left atrial and aortic catheters to assess mean arterial blood pressure (MAP), heart rate (HR), myocardial contractility, cardiac output, and regional blood flow during treadmill running. Each animal exercised for 20 min at 80% of its maximal HR reserve. Exercise was performed in the absense and presence of the ANG II AT(sub 1) receptor antagonist losartan (15-20 mg/kg). ANG II AT(sub 1) receptor blockade attenuated the MAP and systemic vascular resistance responses to dynamic exercise but had no effect on cardiac output, HR, or myyocardial contractility. In addition, blood flow increased and/or regional vascular resistance decreased in the heart, kidneys, stomach, small intestine and colon, whereas the reverse occured in the skin and spleen. These data suggest that ANG II contributes to the increase in MAP and redistribution of cardiac output associated with dynamic exercise. Author (Herner)

A95-83362
TIME-DEPENDENT GLYCEMIC RESPONSE TO EXERCISE IN WINTER AND SPRING IN THE SUBARCTIC
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Twenty healthy athletes exercised for 30 min at four different times (beginning at 1130 and 1630) in December (darkness period) and in April (18h of daylight). Four hours after intake of a standardized meal, a 30-min bike exercise with an intensity of 60% maximal O2 uptake was performed. Blood samples (fingertip) were drawn at 1, 5, 10, and 30 min into exercise and 5, 10, and 30 min after termination of exercise for determination of blood glucose. Glucose values were normalized by reexpressing each as a percentage of the starting value. The total area under the glucose-time curves as well as the area below the starting value was calculated. Areas were tested for the effects of sex, time of day, and season by analysis of variance. For the group as a whole during exercise, a significant effect was found by analysis of variance for sex, time of exercise and season. During recovery, significant differences were found for sex and time of exercise but not for season. The minimal integrated glucose response to exercise occured in females, who also showed the most rapid return to baseline values during the recovery period. Exercise in the morning produced the smallest glucose response for both sexes and faster recovery compared with exercise in the afternoon. This was also the case overall for exercise in December compared with April. This finding implies that the glycemic response may be influenced by season and timing of exercise, which may be of importance to athletes involved in vigorous training and patients with diabetes mellitus. Author (Herner)

A95-83363
RAPID TRACER LACTATE INFLUX INTO CANINE SKELETAL MUSCLE
L. BRUCE GLADDEN, ROBERT E. CRAWFORD, MICHAEL J. WEBSTER, and PETER W. WATT Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 205-211
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This study evaluated the effects of various lactate transport inhibitors and competitors on rapid tracer lactate influx into the canine gastrocnemius-plantaris muscle (GP). GPs of 25 anesthetized dogs were perfused with red blood cell-free media in situ. At 0.9 mM lactate concentration (La), GP oxygen uptake and net lactate output were similar to values during blood perfusion. Rapid tracer lactate influx was inferred by a paired-tracer dilution method at nominal perfusate (La) values of 1, 5, 10, 25, and 50 mM. The maximal tracer influx rate U(sub max) decreased significantly with each increase in unlabeled (La). A saturation effect was suggested by the fact that percent inhibation of U(sub max) began to reach a plateau at the higher unlabeled (La) values. The inhibition of U(sub max) was 20.5 +/- 2.9% at 5mM, 34.1 +/- 3.3% at 10 mM, 47.3 +/- 2.7% at 25 mM, and 56.1 +/- 2.8% at 50 mM (La). U(sub max) was also inhibited by various inhibitors/competitors of lactate transport as follows: 50 mM alpha-cyano-40hydroxy-cinnamate, 1.5 mm phloretin, 0.1mM4,4'-diisothiocyanostilbene-2,2'-disulfonic acid, 0.5 mM p- chloromercuribenzenesulfonic acid, 0.5 mM furosemide, 25mm pyruvate and 50 mm DL-lactate. These experiments support the notion that lactate influx into cannine skeletal muscle is a function of both a linear (possible diffusive) component and a Michaelis-Menten (carrier-mediated) component. Author (Herner)

A95-83364
HEART RATE AND BLOOD PRESSURE VARIABILITIES DURING GRADED HEAD-UP TILT
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We investigated the responses of the frequency components of

heart rate (HR) and blood pressure (BP) variabilities to progressive changes in automatic activity induced by the graded head-up tilt technique in 12 normal subjects (age 19-27 yr) under the condition of frequency-controlled respiration (0.25 Hz). During low-level tilt (0-30deg), the R-R interval was unchanged and the amplitude of the high-frequency (HF; 0.25 Hz) component of HR variability showed only a slight insignificant decrease. The amplitude of the low-frequency (LF; 0.04-0.15 Hz) component of HR variability increased progressively as the angle increased. During high-level tilt (30-90deg), the R-R interval and the HF amplitude of HR variability decreased progressively with the tilt angle. The LF amplitude of the HR variability peaked at a tilt angle of 30deg. The LF-to-HF ratio of HR variability and the LF amplitude of systolic and diastolic BP variabilities increased progressively as the tilt angle increased from 0-60deg, although systolic and diastolic BPs were unchanged. These results suggest that mixed automatic responses to orthostatic stress, which are thought to be mediated by both cardiopulmonary and arterial baroreflex mechanisms, can be distinguished by changes in the frequency components of HR and BP variabilities. Author (Herner)

A95-83365
RELATIONSHIP BETWEEN ATRIAL NATRIURETIC PEPTIDE AND PLASMA VOLUME DURING GRADED EXERCISE WITH WATER IMMERSION

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To assess the relationship between atrial natriuretic peptide (ANP) and the reduction in plasma volume (PV) during exercise, we measured changes in PV and ANP in seven male volunteers during treadmill exercise in air (AE) and with water immersion (WE) together with time control studies of rest in air and in water. Blood samples were collected from a catheter in the antecubital vein at exercise intensities of 32, 49, 65, and 78% of peak oxygen consumption dot-V(sub O2). Plasma ANP in AE increased significantly from the resting value only at 78% of peak dot-V(sub O2), whereas ANP in WE increased significantly at exercise levels of greater than 49% of peak dot-V(sub O2) and reached 68 +/- 9 pg/ml at 78% of peak dot-V(sub O2). Although PV in AE and WE decreased significantly with dot-V(sub O2) of greater than 49% of peak dot-V(sub O2), the decrease from the resting value in WE was significantly greater than that in AE of greater than 65% of peak dot-V(sub O2) and the decreases at 78% of peak dot-V(sub O2) were -9.7 +/- 0.8 and -6.1 +/- 1.7%, respectively. The difference in the decrease in PV between AE and WE at corresponding dot-V(Sub O2) correlated strongly with that in the increase in ANP. These results are consistent with the hypothesis that ANP may be involved in the fluid shift from the intra- to extravascular space during exercise. Author (Herner)

A95-83366
PROTECTIVE EFFECT OF MEPACRINE ON HYPOXIA-REOXYGENATION-INDUCED ACUTE LUNG INJURY IN RATS

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Mepacrine, a cell membrane stabilizer and inhibitor of phospholipase A(sub2) PLA(sub2), exerts a protective effect on ischemia-reperfusion injury in heart; however, its effect in lungs has not been examined. This study aimed to determine whether mepacrine pretreatment attenuates ischemia-reperfusion lung injury simulated by hypoxia reoxygenation and to identify posible mechanisms for such protection. Acute lung injury was induced in Sprague-Dawley rats by ventilation with 5% CO2-95% N2 and 5% CO2-95% air. Pretreatment with 0.06 mM mepacrine significantly attenuated the acute lung injury. Capillary filtration coefficient, lung weight gain, and protein concentration of lung lavage fluid were significantly lower in mepacrine-treated rats than in rats exposed to hypoxia reoxygenation alone. Steroid dexamethasone, another potential PLA(sub 2) inhibitor, had almost no protective effect. Mepacrine but not dexamethasone caused dose-dependent attenuation of the increase in leukocyte chemiluminescence produced by exposure to phorbol myristate acetate. Mepacrine also dose-dependently inhibited production of tumor necrosis factor-alpha (TNF-alpha) by human monocytes; dexamethasone was much less effective in decreasing TNF-alpha production. We conclude that mepacine but not dexamethasone can significantly attentuate a hypoxia-reoxygenation-induced injury of the lung. This protective effect of mepacrine may not be the result of its inhibition of PLA(sub 2) but rather of its downregulation of oxygen radical production by circulating or resident leukocytes or its attenuation of TNF-alpha production by macrophages. Author (Herner)

A95-83367
MEASURMENT OF INTESTINAL VASCULAR CAPACITANCE IN DOGS: AN APPLICATION OF BLOOD POOL SCINTIGRAPHY

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To define relative changes in intestinal vascular capacitance, we developed a model that allowed us to construct intestinal vascular pressure-volume relationships (PVR). Thirteen alpha-chlorase-anesthetized and splenectomized dogs were studied using a pneumatic constrictor and a small catheter to change and measure portal venous pressure. A small lead sheet was placed beneath the abdominal wall. Relative changes in intestinal blood volume (IBV) were determined by in vivo blood pool scintigraphy with Tc-99m-labeled erythrocytes and were expressed as percentages corrected for specific activity and abdominal wall radioactivity. PVRs were constructed using data recorded during graded inflations of the portal venous constrictor. The abdominal wall contributed 32.4 +/- 7.7% (SD) of the total counts. During a 4-h control period, PVRs varied by no more than 6% (of IBV). In the isolated intestinal circulation, the change in IBV was precisely proportional to the volume of blood added, indicating that this method can detect very small changes in volume. Nitroglycerin increased capacitance by 20%. Although it measures only relative changes, this model is stable and sensitive, provides reproducible measurment of intestinal PVRs, and, with adaptation, may prove useful in patient studies. Author (Herner)

A95-83368
STRUCTURAL AND FUNCTIONAL CHARACTERISTICS OF PERIPHERAL PULMONARY PARENCHYMA IN GOLDEN HAMSTERS
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(HTN-95-21583)

Mechanical properties of the peripheral pulmonary parenchyma of freshly excised hamster lung tissue were examined to evaluate determinants of displacement-tension relationships with regard to structural constituents of the alveolar wall. A tissue segment measuring 50 x 50 x 400 - 600 micrometers and consisting mostly of the alveolar wall was prepared from the lung parenchyma adjacent to the pleura. By use of a constant speed maneuver for extension and relaxation of this minute preparation, displacement-tension relationships of peripheral pulmonary parenchyma were examined in a bath filled with 37 C physiological buffer solution. The specimen was repeatedly extended up to 20-40 mg, a little above the point resembling 'yield' in displacement-tension relationships. Analyses of displacement-tension relationships constantly showed double exponential relations. The first component at the lower strain was approximated by sigma (sub 1) = A(sub 1)(e(exp(a(sub 1)epsilon))-1) and the second component beyond the inflection (yield) point was sigma = S(sub 1)+S(sub 2) = A (sub 1)(e(exp(a(sub 1) epsilon))-1) + A(sub 1)(e(exp(a(sub 1) esilon))-1), where sigma, A, a, and epsilon represent stress, constant determined by tissue quantity, elasticity constant, and strain, respectively. Immersion of the lung specimen into elastase resulted in decreases of only a(sub 1) and collagenase reduced a(sub 2) but not a(sub 1). Hyaluronidase, acetylcholine, ethylene glycol-bis (beta-aminoethyl ether)-N,N,N',N'-tetraacetic acid, and norepinephrine did not alter a(sub 1) and a(sub 2). These observations suggest that a(sub 1) and a(sub 2) of the peripheral pulmonary parenchyma are mechanical indexes of elastin and collagen characters, respectively. Author (Herner)

A95-83369
VENTILATORY RESPONSES TO COOLING THE VENTROLATERAL MEDULLARY SURFACE OF AWAKE AND ANESTHETIZED GOATS
PATRICIA J. OHTAKE, HUBERT V. FORSTER, LAWRENCE G. PAN, TIMOTHY F. LOWRY, MARK J. KORDUCKI, ELIZABETH A. AARON, and ERIN M. WEISS Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 247-257
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The ventrolateral medulla (VLM) has been reported to be important as a source of tonic facilitation of dorsal respiratory neurons and as a site critical for respiratory rhythmogenesis. We investigated these theories in awake and anesthetized goats (n = 13) by using chronically implanted thermodes to create reversible neuronal dysfunction at superficial VLM sites between the first hypoglossal rootlet and the pontomedullary junction (area M (rostal) and area S). During halothane anesthesia, bilateral cooling of 60-100% of areas M and S for 30s produced a sustained apnea that lasted beyond the period of cooling. While the animals were awake, cooling the identical region in the same goats resulted in a decrease in pulmonary ventilation, with a brief apnea seen only in one goat. Reductions in both tidal volume and frequency were observed. Qualitatively similar responses were obtained when cooling caudal area M-rostral area S and rostral area M, but the responses were less pronounced. Minimal effects were seen in response to cooling caudal area S. During anesthesia, breathing is critically dependent on superficial VLM neurons, whereas in the awake state these neurons are not essential for the maintenance of respiratory rhythm. Our data are consistent with these superficial VLM neuronal regions providing tonic facilitation to more doral respiratory neurons in both the anesthetized and awake states. Author (Herner)

A95-83370
EFFECTS ON BREATHING OF VENTROLATERAL MEDULLARY COOLING IN AWAKE GOATS
H. V. FORSTER, P. J. OHTAKE, L. G. PAN, T. F. LOWRY, M. J. KORDUCKI, E. A. AARON, and A. L. FORSTER Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 258-265
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(HTN-95-21585)

Our objective was to investigate the role of the ventrolateral medulla (VLM) in the control of breathing during the awake state. In 17 awake adult goats, chronically implanted thermodes were used to cool the VLM and thereby cause reversible neuronal dysfunction in all or portions of the area between the first hypoglossal rootlet and the ponto-medullary junction (so-called area M (rostral) and area S). Within 5 s after the initiation of cooling, 60-100% of areas M and S, pulmonary ventilation (dot-VE) decreased uniformly over conditions of eucapnia, hypercapnia, hypoxia, and exercise. Between 10 and 20 s of cooling, the reduction in dot-VE was appproximately 10% greater during eucapnia and hypercapnia than during hypoxia and exercise. For the remaining 10 s of cooling and for about 1 min after cooling, dot-VE increased to and above control level. Cooling only rostral area M or only caudal area M-rostral area S affected breathing qualitatively in the same manner as when 60-100% of the areas M and S were cooled. However, cooling caudal area S had effects that differed significantly from more rostral cooling in that the initial decrease in dot-VE was attenuated and the subsequent increase was accentuated. The initial uniform decreased dot-VE during cooling suggests that superficial VLM nonchemoreceptor neurons facilitate breathing. The subsequent relatively greater effect of cooling during eucapnia and hypercapnia probably reflects dysfunction of chemoreceptor-related neurons that normally stimulate breathing. The stimulation of breathing during the later stages and after cooling may suggest that some VLM neurons inhibit breathing. Author (Herner)

A95-83371
BASAL FAT OXIDATION DECREASES WITH AGING IN WOMEN
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(HTN-95-21586)

The present study tested the hypothesis that a decrease in basal fat oxidation in aging women is related to a loss of fat-free mass. Thirty-two non-smoking women with a wide range of ages (18-73 yr) were characterized for body composition (underwater weight), maximal aerobic capacity, and basal fat oxidation (indirect calorimetry). Results showed that fat oxidation was negatively correlated with age but was positively correlated with the fat-free mass and with the level of aerobic fitness (maximal aerobic capacity). Unexpectedly, fat oxidation had no relationship with fat mass. Partial correlation analysis showed that the decline in fat-free mass, and not the age or maximal O2 consumption, was the best single predictor of the decline in basal fat oxidation. These results support the theory that a decrease in fat oxidation with advancing age in healthy women is associated with a decrease in the fat-free mass and not age per se. Interventions that increase or preserve the quantity of fat-free mass (e.g., exercise training) may enhance fat oxidation and thus lessen the age-associated adiposity in women. Author (Herner)

A95-83372
UNIDIRECTIONAL SODIUM AND POTASSIUM FLUX IN MYOGENIC L6 CELLS: MECHANISMS AND VOLUME-DEPENDENT REGULATION
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To clarify the relative participation of particular ion transport systems in net univalent cation fluxes under basal conditions and altered volume of skeletal muscle-derived cells, the effect of inhibitors of the Na(+) -K(+) pump (ouabain), univalent ion cotransporters (bumetanide, furosemide, and (dihydroindenyl)oxy alkanoic acid), and Na(+)/H(+) exchanger (ethylisopropylamiloride) on Rb-86 and Na-22 fluxes has been studied in L6 myoblasts incubated in isosmotic (320 mosmol/kg) and anisosmotic media. Under the isosmotic condition, the relative contribution of ouabain-inhibited and ouabain-insensitive bumetanide-inhibited component of Rb-86 influx was approximately 15-20 and 60%, respectively. Na-22 influx was inhibited by bumetanide and ethylisopropylamiloride by 25 and 15%, respectively. Under isosmotic conditions, an increase of L6 cell volume was observed after addition of extracellular acetylcholine, extracellular K(+)-induced depolarization, or lowering of the pH of the incubation medium. High extracellular glutathione (150 micrometer) did not affect the cell volume of the muscle-derived cells bathed in isosmotic medium. Results of this study suggest that the bumetanide-inhibited component of K(+) influx plays a key role in the adjustment of transmembrane K(+) gradient in L6 myoblasts. The Na(+)/H(+) exchanger appears to be important in regulatory volume increase. Author (Herner)

A95-83373
HOW MODE OF STIMULUS AFFECTS THE RELATIVE CONTRIBUTION OF ELASTANCE AND HYSTERESIVITY TO CHANGES IN LUNG TISSUE RESISTANCE
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Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 282-287 Research sponsored by J.T.Costello Memorial Research Fund
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Challenges with high concentrations of constrictor agonist delivered by intravenous vs. aerosol result in different modifications of the mechanical properties of lung tissues. We questioned whether low doses of a smooth muscle agonist administered via different routes (aerosol, iv bolus, iv continuous infusion) or an increase in positive end-expiratory pressure (PEEP) would result in different mechanical perturbations of lung tissues. Tracheal and alveolar pressures and flows were measured in open-chest mechanically ventilated (frequency 1 Hz, tidal volume 10 ml/kg, PEEP 4 cmH2O) rats under baseline conditions and after administration of low doses of methacholine of after increases in PEEP. We calculated lung elastance (EL), lung resistance, and tissue resistance (Rti) by fitting the equation of motion to changes in tracheal and alveolar pressures. Airway resistance and hysteresivity (eta) were derived from the above measurements. For comparable increases in Rti, the aerosol and PEEP groups showed large increases in EL with a decrease in eta, whereas the two intravenous groups showed large increases in eta with smaller increases in EL. The largest contribution of eta to the overall increase in Rti was seen in the intravenous bolus group. When induced changes in EL vs. induced changes in eta were plotted, different relationships were found for the four groups. We conclude that despite similar increases in Rti a different kind of mechanical perturbation occurred in the lung tissues that depended on the nature of the stimulus. Author (Herner)

A95-83374
INFLUENCE OF MUSCLE GLYCOGEN ON GLYCOGENOLYSIS AND GLUCOSE UPTAKE DURING EXERCISE IN HUMANS
MARK HARGREAVES University of Melbourne, Parkville, Victoria, Australia, GLENN MCCONELL University of Melbourne, Parkville, Victoria, Australia, and JOSEPH PROIETTO University of Melbourne, Parkville, Victoria, Australia
Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 288-292 Research sponsored by National Health and Medical Research Council of Australia
(HTN-95-21589) Copyright

To examine the effects of alterations in preexercise muscle glycogen availabiliity on glycogenolysis and glucose uptake during exercise, 12 active but untrained men were studied during 40 min of cycle ergometer exercise at 65-70% peak pulmonary oxygen uptake on two separate occasions, at least one wk apart. Preexercise muscle glycogen concentrations were manipulated by having the subjects perform glycogen-lowering exercise either 24 or 48 h before a trial, in combination with either high or low dietary carbohydrate intake. In series 1(n = 7), increasing muscle glycogen from 90.3 +/- 6.0 to 124.7 +/- 10.8 mmol/kg wet wt increased muscle glycogenolysis during exercise. Similarly, in series 2 when muscle glycogen was reduced from 96.2 +/- 6.6 to 53.7 +/- 6.0 mmol/kg, glycogen utilization during exercise was reduced from 51.8 +/- 4.6 to 28.3 +/- 3.8 mmol/kg. The altered muscle glygogen utilization was associated with alterations in carbohydrate oxidation during exercise, without effect on tracer (H-3 glucose)-determined glucose uptake. These results indicate that preexercise muscle glycogen availability influences muscle glycogenolysis, but not glucose uptake, during exercise. Author (Herner)

A95-83375
HYPERTROPY AND PROLIFERATION OF SKELETAL MUSCLE FIBERS FROM AGED QUAIL
JAMES A. CARSON Ohio State University, Columbus, OH, US, MAMORU YAMAGUCHI Ohio State University, Columbus, OH, US, and STEPHEN E. ALWAY Ohio State University, Columbus, OH, US
Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 293-299
(Contract(s)/Grant(s): NIH-AG-10871)
(HTN-95-21590) Copyright

The purpose of this study was to determine whether fibers in the anterior latissimus dorsi (ALD) muscle from aged Japanese quail have decreased hypertrophic or proliferative resposes to 30 days of stretch overload compared with fibers from adult birds. Two groups of quail were studied, 12-wk-old quail (adult; n = 16) and 90-wk-old quail (aged; n = 16). The left wing of each bird was overloaded with a weight corresponding to 10% of the bird's body weight, and the right wing served as the intra-animal control. Quails were killed after 30 days of stretch overload. Total fiber number was quantified by counting all the fibers in a transverve section from the midbelly of the ALD muuscle. ALD muscles in aged quails retained the capacity to increse their muscle mass (145%), total fiber number (49%), and fiber cross-sectional area (54%) in response to stretch overload. The ADL muscles in aged quail had a significanly lower increase in muscle mass (33%) and mass corrected for nonmuscle tissue (36%) compared with the ALD from the young adult birds. Age had no effect on fiber type distribution shifts with stretch. These results suggest that although muscles in old birds have a substantial ability to adapt to enlarge, stretch-induced hypertrophy is attenuated in muscles from old quail. Author (Herner)

A95-83376
EFFECTS OF EXERCISE INTENSITY ON INSULIN SENSITIVITY IN WOMEN WITH NON-INSULIN-DEPENDENT DIABETES MELLITUS
BARRY BRAUN, MICHAEL B. ZIMMERMAN, and NORMAN KRETCHMER
Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 300-306
(Contract(s)/Grant(s): NIH-5-T32-HD-07255-05)
(HTN-95-21591) Copyright

Exercise enhances insulin sensitivity in people with non-insu-

lin-dependent diabetes mellitus (NIDDM), but the intensity of exercise necessary to optimize the effect is unknown. Eight women with NIDDM were studied on a metabolic ward in each of three conditions: (1) low-intensity exercise (LO) that consisted of treadmill walking at 50% of maximal O2 consuption on days 1 and 2, (2) high-intensity exercise (HI) that consisted of walking at 75% of maximal O2 consumption, and (3) no exercise (NX). The duration of exercise was adjusted so that energy expenditure was equal in both exercise conditions. On day 3, glucose (6,6-H-2) glucose, and insulin were infused at fixed rates for 3 h. Insulin sesitvity was determined both by steady-state plasma glucose concentration and rate of glucose disposal per unit plasma insulin. Steady-state plasma glucose concentration and rate of glucose disposal per unit plasma insulin were almost identical after LO or HI; values were significantly greater than after NX. Plasma glucose response to a test meal was the same among the three conditions, but plasma insulin response was lower for HI and LO compared with NX. We conclude that under these conditions LO is as effective as HI in enhancing insulin sensitivity in people with NIDDM. Author (Herner)

A95-83377
BETA-ADRENOCEPTOR BLOCKADE AND SKELETAL MUSCLE ENERGY METABOLISM DURING ENDURANCE EXERCISE
M. A. VAN BAAK, A. DE HAAN, W. H. M. SARIS, E. VAN KORDELAAR, H. KUIPERS, and G. J. VAN DER VUSSE Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 307-313
(HTN-95-21592) Copyright

Twelve healthy male volunteers cycled to exhaustion at a workload corresponding to 70% of maximal aerobic power after administration of 80 mg of the beta (sub 1 + 2)-adrenoceptor antagonist propranolol and after administration of placebo by mouth. Exercise times until exhaustion were 39 +/- 7 and 86 +/- 7 min in the propranolol and placebo groups, respectively. Muscle inosine 5'-monophosphate content was significantly increased above resting levels at exhaustion after placebo. At exhaustion after propranolol, inosine 5'-monophosphate was not increased significantly and was lower than at exhaustion after placebo. No changes in ATP and the total adenine nucleotide content during exercise were found in the two tests. Muscle glycogen content was significantly reduced at exhaustion after placebo as well as after propranolol, but the levels were still significantly higher at exhaustion after propranolol than after placebo. No evidence for shift in glycogen utilization among types I, IIa,and IIb fibers after propranolol was found. The results show that neither an imbalance between ATP utilization and ATP regeneration nor premature glycogen depletion, either in the whole muscle or in specific muscle fiber types, provides a satisfactory explanation for the premature fatigue during endurance exercise after propranolol. Author (Herner)

A95-83378
HYPOTHERMIC EFFECT OF MELATONIN AND NOCTURNAL CORE BODY TEMPERATURE DECLINE ARE REDUCED IN AGED WOMEN
ANGELO CAGNACCI University of California, San Diego, La Jolla, CA, US, RENZA SOLDANI University of California, San Diego, La Jolla, CA, US, and SAMUEL S. C. YEN University of California, San Diego, La Jolla, CA, US Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 314-317
(Contract(s)/Grant(s): NIH-HD-12303-14; NIH-HD-21198-5; NIH-RR-00827)
(HTN-95-21593) Copyright

In young humans, the nocturnal rise of the hypothermic hormone melatonin generates 40-50% of the circadian core body temperature (T(sub c)) decline. The nocturnal T(sub c) decline is reduced with aging in men. In this study we investigated whether a similar attenuation occurs in women and whether it is associated with a reduced serum concentration and/or action of melatonin. The circadian rhythms of melatonin and T(sub c) (measured in the vagina) and the reponses of both T(sub c) (measured into the auricolar canal) and finger skin temperature to melatonin administration were investigated in two experiments involving young (22-32 yr) and aged (54-62) women. In aged women, the nocturnal onset of the melatonin rise was phase advanced and T(sub c) decline and T(sub c) rhythm amplitude were reduced. The serum melatonin concentrations in aged women were similar to those of young women, but the melatonin capability to reduce T(sub c) and increase skin temperature was markedly impaired. Our data show that, in women, an aging-associated reduction of temperature responses to melatonin is probably involved in inducing an attenuation of the nocturnal T(sub c) decline and circadian T(sub c) rhythm amplitude. Author (Herner)

A95-83379
PREDICTING HEART RATE RESPONSE TO VARIOUUS METABOLIC RATES, ENVIRONMENTS, AND CLOTHING
D. MORAN, Y. EPSTEIN, A. LAOR, A. VITALIS, and Y. SHAPIRO Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 318-322 Research sponsored by Ministry of Labor and Social Affairs, Israel
(HTN-95-21594) Copyright

A mathematical model that describes heart rate (HR) responses to different combinations of metabolic levels, climatic conditions, and clothing ensembles was developed. The database that served to construct the model consisted of 48 variations representing a wide range of environmental conditions, clothing ensembles, and metabolic rates. The model, which correlates highly with observed values, is based on physiological and environmental parameters: HR = 57.1 + 0.6 HR(sub i) + (0.07M - 19.06 - 0.011(E(sub max) - E(sub req) log t where HR(sub i) is initial HR in beats per minute (at rest before the exposure), t is the time of exposure in minutes, M is the metabolic rate in watts, E(sub req) is the required sweat evaporation for thermal equilibrium in watts, and E(sub max) is the maximal evaporative capacity of the environment in watts. The model's validity was tested by using two independent databases representing wide ranges of conditions; the correlation between measured and predicted values was found to be highly significant. In summary, the present study suggests a valid predictive model for HR that overcomes some of the difficulties observed in other models. Author (Herner)

A95-83380
HUMAN PULMONARY VASCULR AND VENOUS COMPLIANCES ARE REDUCED BEFORE AND DURING LEFT-SIDED HEART FAILURE
SENRI HIRAKAWA Gifu University School of Medicine, Gifu, Japan, TAKAHIKO SUZUKI Gifu University School of Medicine, Gifu, Japan, KOSHI GOTOH Gifu University School of Medicine, Gifu, Japan, HIROYASU ITO Gifu University School of Medicine, Gifu, Japan, TSUTOMU TANAKA Gifu University School of Medicine, Gifu, Japan, YUKIO OHSUMI Gifu University School of Medicine, Gifu, Japan, YASUO YAGI Gifu University School of Medicine, Gifu, Japan, YASUSHI TERASHIMA Gifu University School of Medicine, Gifu, Japan, HIDEKI FUJIWARA Gifu University School of Medicine, Gifu, Japan, KENSHI NAGASHIMA Gifu University School of Medicine, Gifu, Japan et al. Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 323-333
(HTN-95-21595) Copyright

Human pulmonary vascular and venous compliances were measured in 41 patients with or without left-sided heart failure. Two methods were used. Method 1 was based on analysis of pulmonary capillary wedge (PCW) pressure tracings according to C(sub V,PCW) = (SF/100)(0.075PCW + 0.90) SV/((v-d)(sub PCW) + 1), were C(sub V,PCW) is compliance of pulmonary venous system, SF is systolic fraction of pulmonary venous flow (related to pulmonary capillary wedge pressure (PCW) as SF = 82 - 2.01PCW), (v-d)(sub PCW) is pulse pressure in PCW position, and SV is stroke volume. The (0.075PCW + 0.90) term equals K(double prime), i.e., systolic run-off ratio. Method 2 was used to measure to pulmonary vascular volume-pressure (V-P) relationship and pulmonary vascular compliance C(sub vasc) and is based on measurment of pulmonary blood volume (PBV) and its increase with passive elevation of the legs to

calculate C(sub vasc). Assuming the proportion of blood entering pulmonary venous sytem (in increase of PBV) during passive leg elevation to be 0.8, pulmonary venous compliance C(sub V,PBV) was calculated as C(sub V,PVB) = 0.8C(sub vasc). C(sub V,PCW) correlated fairly closely with C(sub V,PBV) (r = 0.81, coefficient of variation = 31%). This fair agreement between between two independent methods suggests strongly that both methods may be valid, although other interpretations are possible. C(sub V,PCW), (C(sub vasc), and C(sub v,PBV) decreased going from New York Heart Association class 1 to classes 2 and 3. When PBV was plotted vs. PCW, average V-P line for class 2 patients was flatter and shifted downward to the right compared with that for class 1. This suggests pulmonary vasoconstriction as well as other factors. Average V-P line for class 3 patients is flatter but not displaced compared with that for class 2. Another previously reported series of 50 patients, most of whom had ischemic heart disease, are included in this study.

Author (Herner)

A95-83381
EFFECTS OF STRENGTH AND ENDURANCE TRAINING ON THIGH AND LEG MUSCLE MASS AND COMPOSITION IN ELDERLY WOMEN

SARIANNA SIPILA University of Jyvaskyla, Jyvaskyla, Finland and HARRI SUOMINEN University of Jyvaskyla, Jyvaskyla, Finland Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 334-340 Research sponsored by the Ministry of Education, Finland

(HTN-95-21596) Copyright

The effects of 18 wk of intensive strength and endurance training on knee extensor, knee flexor, and lower leg muscle mass and composition were studied in 76- to 78-yr-old women. Muscle cross-sectional area(CSA), lean tissue CSA, and relative proportion of fat were determined using computed tomography. The strength-trained women increased their total muscle lean tissue CSA of the thigh, quadriceps CSA, quadriceps lean tissue CSA and mean Hounsfield unit of the lower leg muscles compared with the changes that occured in the control group during the experiment. The change in quadriceps lean tissue CSA because of the strength training was also significant compared with that in the endurance group. The relative proportion of fat within the quadriceps muscle decreased due to the strength training compared with the changes that occured in the endurance group. The results show that intensive strength training can induce skeletal muscle hypertrophy in elderly women and thereby also reduce the relative amount of intramuscular fat, whereas the effects of endurance training are negligible.

Author (Herner)

A95-83382
INHALED NITRIC OXIDE DOES NOT ALTER THE LONGITUDINAL DISTRIBUTION OF PULMONARY VASCULAR RESISTANCE

DENNIS M. LINDEBORG Stanford University Medical Center, Stanford, CA, US, BRIAN P. KAVANAGH Stanford University Medical Center, Stanford, CA, US, KRISA VAN MEURS Stanford University Medical Center, Stanford, CA, US, and RONALD G. PEARL Stanford University Medical Center, Stanford, CA, US Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 341-348 Research sponsored by the American Heart Association

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Because the effects of inhaled nitric oxide (NO) may be localized to its site of delivery, we studied the effects of inhaled NO on the longitudinal distribution of pulmonary vascular resistance during pulmonary hypertension in perfused rabbit lungs. Before NO administration, pulmonary hypertension was produced by infusion of the thromboxane A(sub2) mimetic U-46619 in all lungs. Pulmonary vascular resistance was divided into arterial, microvascular, and venous components by arterial and venous occlusion techniques. In the buffer-perfused lung, all doses of inhaled NO (5, 20, and 80 ppm) produced small decreases in pulmonary arterial pressure (Ppa), with equivalent proportional reductions in all segmental vascular resistances. Similar results were obtained after an extended inhaled NO dose range of 20, 80, and 240 ppm. In the buffer-perfused lung, inhibition of endogenous NO synthesis with N(sup G)-nitro-arginine methyl ester (L-NAME) potentiated the effects of U-46619. Subsequent inhaled NO administration produced larger decreases in Ppa with equivalent proportional reductions in all segmental vascular resistances. In the blood-perfused lung, L-NAME did not alter baseline pulmonary pressures. Administration of inhaled no during U-46619-induced pulmonary hypertension produced dose-related decreases in Ppa. The highest dose (80 ppm) ofinhaled NO decreased Ppa by 3.5 mmHg, with equivalent proportional reductions in all segmental vascular resistances. We conclude that inhaled NO does not selectively alter the longitudinal distrbiution of pulmonary vascular resistance and that the magnitude of reduction in total pulmonary vascular resistance in the isolated perfused rabbit lung depends on the endogenous NO synthesis and on the use of buffer or blood as the perfusate.

Author (Herner)

A95-83383 National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
IS WALKING A RANDOM WALK? EVIDENCE FOR LONG-RANGE CORRELATIONS IN STRIDE INTERVAL OF HUMAN GAIT

JEFFREY M. HAUSDORFF, C.-K. PENG, ZVI LADIN, JEANNE Y. WEI, and ARY L. GOLDBERGER Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 349-358

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(HTN-95-21598) Copyright

Complex fluctuation of unknown origin appear in the normal gait pattern. These fluctuations might be described as being (1) uncorrelated white noise, (2) short-range correlations, or (3) long-range correlations with power-law scaling. To test these possibilities, the stride interval of 10 healthy young men was measured as they walked for 9 min at their usual rate. From these time series we calculated scaling indexes by using a modified random walk analysis and power spectral analysis. Both indexes indicated the presence of long-range self-similar correlations extending over hundreds of steps; the stride interval at any time depended on the stride interval at remote previous times, and this dependence decayed in a scale-free (fractallike) power-law fashion. These scaling indexes were significantly different from those obtained after random shuffling of the original time series, indicating the importance of the sequential ordering of the stride interval. We demonstrate that conventional models of gait generation fail to reproduce the observed scaling behavior and introduce a new type of central pattern generator model that sucessfully accounts for the experimentally observed long-range correlations. Author (Herner)

A95-83384* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
AGE DEPENDENCE OF MYOSIN HEAVY CHAIN TRANSITIONS INDUCED BY CREATINE DEPLETION IN RAT SKELETAL MUSCLE

GREGORY R. ADAMS University of California, Irvine, CA, US and KENNETH M. BALDWIN University of California, Irvine, CA, US Journal of Applied Physiology (ISSN 8750-7587) vol. 78, no. 1 January 1995 p. 368-371

(Contract(s)/Grant(s): NAG2-555)

(HTN-95-21599) Copyright

This study was designed to test the hypothesis that myosin heavy chain (MHC) plasticity resulting from creatine depletion is an age-dependent process. At weaning (age 28 days), rat pups were placed on either standard rat chow (normal diet juvenile group) or the same chow supplemented with 1% wt/wt of the creatine analogue beta-guanidinopropionic acid (creatine depletion juvenile (CDJ) group). Two groups of adult rats (age approximately 8 wk) were placed on the same diet regimens (normal diet adult and creatine depletion adult (CDA) groups). After 40 days (CDJ and normal diet juvenile groups) and 60 days (CDA and normal diet adult groups), animals were killed and several skeletal muscles were removed for

analysis of creatine content or MHC ditribution. In the CDJ group, creatine depletion (78%) was accompanied by significant shifts toward expression of slower MHC isoforms in two slow and three fast skeletal muscles. In contrast, creatine depletion in adult animals did not result in similar shifts toward slow MHC isoform expression in either muscle type. The results of this study indicate that there is a differential effect of creatine depletion on MHC tranitions that appears to be age dependent. These results strongly suggest that investigators contemplating experimental designs involving the use of the creatine analogue beta-guanidinopropionic acid should consider the age of the animals to be used. Author (Herner)

A95-83386
DYNAMIC MUTATIONS
GRANT R. SUTHERLAND Women's and Children's Hospital, Adelaide, Australia and ROBERT I. RICHARDS Women's and Children's Hospital, Adelaide, Australia American Scientist (ISSN 0003-0996) vol. 82, no. 2 March-April 1994 p. 157-163
(HTN-95-00506) Copyright

Dynamic mutation contributions to disease provide considerable insight into the curious inheritance patterns of those diseases. Gene mutations were thought to be stable and give rise to similar effects on all members of the species. The newly described mutations are unstable and can change each time they are transmitted from parent to child. Dynamic mutations behave differently depending on the sex of the parent transmitting the gene. Fragile X Syndrome is discussed, tracking the normal and asymptomatic males. The DNA sequence composition is described. Plausible theories on how p mutations arise and expand to a full mutation are examined. Herner

A95-83387
THERMOREGULATION IN BEES
BERND HEINRICH University of Vermont, Burlington, VT, US and HARALD ESCH University of Notre Dame, South Bend, IN, US American Scientist (ISSN 0003-0996) vol. 82, no. 2 March-April 1994 p. 164-170
(HTN-95-00507) Copyright

Thermoregulatory behavior is particularly well developed in bees, which can adjust their body temperatures over a wide range of environmental conditions. The mechanisms developed to accomplish daily tasks are as diverse as the bees themselves. Much of the research was concentrated on bumble bees, carpenter bees, and honeybees. Although the immediate objective was to study the extremes of adaptation, the end result is a general understanding of how the thermal environment has shaped bees. Flight warm-up heart loops in honey bees, heat loss in bumble bees, free cooling in carpenter bees are discussed. Herner

A95-83867
THE EVOLUTION OF LIFE WITHOUT OXYGEN
TOM FENCHEL University of Copenhagen, Copenhagen, Denmark and BLAND J. FINLAY Institute of Freshwater Ecology, Ambleside, UK American Scientist (ISSN 0003-0996) vol. 82, no. 1 January-February 1994 p. 22-29
(HTN-95-42101) Copyright

The biology and ecology of protozoa living in oxygen-free habitats were studied. Their strange and specialized symbioitc relationships with bacteria were examined. These relationships are intriguing because they provide a contemporary analogy for the symbiotic origin of mitochondria, the organelles responsible for energy metabolism. They also shed light on the behavior of biological communities as they might have functioned three billion years ago, before the wide-spread distribution of oxygen. Anaerobic community structure is decribed. Herner

A95-83871
THE EMERGENCE OF NEW DISEASES
RICHARD LEVINS Harvard School of Public Health, Boston, MA, US, TAMARA AWERBUCH Harvard School of Public Health, Boston, MA, US, UWE BRINKMANN Harvard School of Public Health, Boston, MA, US, IRINA ECKARDT Harvard School of Public Health, Boston, MA, US, PAUL EPSTEIN Harvard School of Public Health, Boston, MA, US, NAJWA MAKHOUL Harvard School of Public Health, Boston, MA, US, CRISTINA ALBUQUERQUE POSSAS Harvard School of Public Health, Boston, MA, US, CHARLES PUCCIA Harvard School of Public Health, Boston, MA, US, ANDREW SPIELMAN Harvard School of Public Health, Boston, MA, US, and MARY E. WILSON Harvard School of Public Health, Boston, MA, US American Scientist (ISSN 0003-0996) vol. 82, no. 1 January-February 1994 p. 52-60
(HTN-95-42105) Copyright

Lessons learned from the emergence of new diseases and the resurgence of old ones may help us prepare for future epidemics. The factors that encourage the emergence and spread of new diseases must be identified. To do that, complex social, epidemiological, ecological, and evolutionary processes must be integrated to understand how events in the various dimensions interact under changing circumstances to produce radically new health problems. Recent trends as a part of epidemiological history are examined and the progress of human diseases, as well as those of plants and animals are explored. Concurrent concepts are applied and the conceptual framework that guides our present strategy of diseases control is re-examined. Herner

A95-84063
ON THE ABSOLUTE MEANING OF THE ENERGY SCALE APPROXIMATELY KT IN THE THERMAL INTERFERENCE INVOLVED IN ENZYME-COUPLED REACTIONS
KENICHIRO MOGI Institute of Physical and Chemical Research, Saitama, Japan Royal Society (London), Proceedings, Series A - Mathematical and Physical Sciences (ISSN 0962-8444) vol. 445, no. 1925 June 8, 1994 p. 529-541
(HTN-95-92207) Copyright

I propose a novel mechanism involved in enzyme-catalyzed coupled reactions in biological systems. It is assumed that an enzyme sets a constraint on the coupling ratio between the degrees of freedom coupled in the reaction. I show that this assumption leads to a mixing of free energy values between the degrees of freedom coupled in the reaction. This is an interference effect of thermal origin, which shares some properties with the quantum interference effect. I discuss the possibility that the energy scale approximately kT has an absolute meaning in determining the magnitude of the thermal interference effect. Author (Herner)

A95-84370
IMAGE SENSING AND PROCESSING BY A BACTERIORHODOPSIN-BASED ARTIFICIAL PHOTORECEPTOR
TSUTOMU MIYASAKA Fuji Photo Film Co., Ltd, Kanagawa, Japan and KOICHI KOYAMA Applied Optics (ISSN 0003-6935) vol. 32, no. 31 November 1 1993 p. 6371-6379 refs
(BTN-94-EIX95012419652) Copyright

A biolelctronic image sensor is fabricated by using 256-pixel bacteriorhodopsin (bR) based artificial photoreceptors. Advanced application of visual functions using present system required as a retina model for obtaining material level, real time processing of visual information. EI

A95-85209
CONSTRUCTING VISUAL PERCEPTION
LEIF H. FINKEL Univ. of Pennsylvania, Philadelphia, PA, US and P. SAJDA Univ. of Pennsylvania, Philadelphia, PA, US American Scientist (ISSN 0003-0996) vol. 82, no. 3 May - June 1994 p. 224-237 Research sponsored ONR
(HTN-95-81495) Copyright

The problem of visual perception has often been thought of as a problem of inverse optics. Most of the underlying computational mechanisms (how vision actually works) were completely unknown. In the past few years, a convergence of discoveries in neurophysiology, psychophysics, and computer modeling has begun to show how the brain may generate visual perception. The construction of neural networks is examined. Perceptual organization and the

gestalt are discussed. Surface segmentation, contour binding, direction of figure, dual mechanisms for binding, and cues to the third dimension are analyzed. Resurrecting the gestalt and perceptual integration are related. Herner

A95-85211
UNTANGLING THE EVOLUTION OF THE WEB
WILLIAM A. SHEAR Hampden-Sydney College, Hampden-Sydney, VA, US American Scientist (ISSN 0003-0996) vol. 82, no. 3 May - June 1994 p. 256-266
(HTN-95-81497) Copyright

The delicate tracery of a spider's web must be one of the most unlikely candidates for fossilization in all of nature. Despite the almost complete lack of a fossil record for spider's webs, and only a very sketchy one for spiders themselves, information from anatomy, systematics, ethology, and ecology has been combined to produce hypothesis about the course that evolution has taken in forming this arachnid artifact. Predictions from these hypothesis can be checked by careful studies of web types old and new, and the results of these observations will lead to further refinements. Author (Herner)

A95-85338
SUPERCOMPUTING STUDIES OF BIOMEMBRANES
TERRY R. STOUCH Bristol-Myers Squibb Pharmaceutical Research Inst., Princeton, NJ, US, HOWARD E. ALPER Bristol-Myers Squibb Pharmaceutical Research Inst., Princeton, NJ, US, and DONNA BASSOLINO-KLIMAS Bristol-Myers Squibb Pharmaceutical Research Inst., Princeton, NJ, US International Journal of Supercomputer Applications (ISSN 0890-2720) vol. 8, no. 1 1994 p. 6-23
(HTN-95-92294) Copyright

Although computer simulation of biological molecules has seen widespread growth and is widely accepted as an important biochemical tool, it is hampered by limited computing resources. Biomolecular systems, by necessity, contain a large number of interaction sites. In many cases, these sites interact over quite large distances. Further, the time scales of biological interest are long, which requires that simulations of dynamical properties at the atomica level must be lengthy to adequately probe these motions. We address these issues through discussions of atomic-level molecular dynamics simulations of biological lipid bilayer membranes, which are key constructs in biochemistry. These simulations reproduce many experimental observables and provide a degree of resolution currently unavailable experimentally. The lengths of these simulations, the longest of which was 2 nanoseconds, were sufficient to effectively sample many of the motions governing the behavior of biomembranes. Examples are given showing the importance of long-range interactions. The number of interaction sites required by these simulations is discussed, particularly the need for explicit representation of solvent molecules. Author (Herner)

A95-85340
MOLECULAR DYNAMICS AT A CONSTANT PH
JOHN E. MERTZ CRAY Research Inc., Eagan, MN, US and B. MONTGOMERY PETTITT University of Houston, Houston, TX, US International Journal of Supercomputer Applications (ISSN 0890-2720) vol. 8, no. 1 1994 p. 47-53 Research sponsored by CRAY Research Inc.
(HTN-95-92296) Copyright

The dynamic equilibrium that exists in a chemically reacting system can be simulated using classical mechanics if the appropriate statistical mechanical ensemble is chosen. This paper describes a general method that makes it possible to simulate this equilibrium in a simple chemical reaction through the use of a recently developed grand canonical molecular dynamics method. After a brief description of the method, an example calculation is performed that simulates the acid-base equilibrium between acetic acid and water. The computational demands of this application are discussed along with a description of a new massively parallel processors (MPP) algorithmic approach to this application. Author (Herner)

A95-85362
THE SENSE OF TASTE
SUSAN MCLAUGHLIN and ROBERT F. MARGOLSKEE American Scientist (ISSN 0003-0996) vol. 82, no. 6 November-December 1994 p. 538-545
(HTN-95-92318) Copyright

The internal molecular workings of the taste bud help it distinguish the bitter from the sweet. The shape of a molecule that simulates taste does indeed determine which taste modality it simulates. The salt, sweet, bitter, and sour taste buds are localized on a different area of the tongue. The mechanisms of taste are discussed. Molecular biological techniques are used to clone specific components of taste-transduction on pathways. These techniques allow the isolation of genes encoding some of the components of taste transduction pathways. Many questions about taste transduction remain to be answered and molecular biology may provide the necessary insight. Herner

A95-85363
EVOLUTION OF THE EARLY VERTEBRATES
PETER FOREY and PHILIPPE JANVIER American Scientist (ISSN 0003-0996) vol. 82, no. 6 November-December 1994 p. 554-565
(HTN-95-92319) Copyright

Recent discoveries of different kinds of ostracoderns, combined with acid-etching techniques that remove, either the rock or the bone, have dramatically increased knowledge of these creatures and their relationships to modern vertebrates. Our results are consistent with the notion that hagfishes are the most primitive vertebrates known (living or extinct) and that the lamphrey is more closely related to gnathostomes then either is to the hagfishes. Although many questions in the evolution of vertebrate structure remain unanswered, the ostracoderms provide information that no other source could have given. As the recent history of the field shows, new techniques of preparing and observing the fossils may reveal previously unnoticed details. Herner

A95-85365
THE EARLY EVOLUTION OF THE DOMESTIC DOG
DARCY F. MOREY University of Tennessee, Knoxville, TN, US American Scientist (ISSN 0003-0996) vol. 82, no. 4 July-August 1994 p. 336-347 Research sponsored by the U.S. Department of Education, the Smithsonian Institution, the American-Scandinavian Foundation and the Wenner-Gren Foundation for Anthropological Research
(HTN-95-92321) Copyright

Archaeological records indicate that the domestic dog, canis familiaris, was likely the first domesticated animal. Dogs are an appropriate focal point for an ongoing debate about the origins and nature of animal domestication. Central to this discussion is the issue of intentionality — whether domestication must be understood as a human decision, as is commonly thought, or rather is best modeled as a strictly evolutionary process. Domestication as a human design, human associations, evolution in a domestic setting, and evolutionary paedomorphs are examined. Herner

A95-85367
THE UNIQUE VISUAL SYSTEM OF THE MANTIS SHRIMP
THOMAS W. CRONIN University of Maryland, Baltimore, MD, US, N. JUSTIN MARSHALL University of Sussex, UK, and MICHAEL F. LAND University of Sussex, UK American Scientist (ISSN 0003-0996) vol. 82, no. 4 July-August 1994 p. 356-365
(HTN-95-92323) Copyright

Evolution comes up with some curious solutions to problems of seeing. The mantis shrimp perceives depth, multiple shades of color, and polarized light. The visual system in many ways is capable of analyzing light in a manner that surpasses any other known group of animals. The eyes of the mantis shrimp offers a perspective from which to view the general principles of visual design and evolution. Triple overlaps of visual field, polychromatic vision, diverse classes

of polarization-sensitive photoreceptors are discussed in terms of its long isolated evolutionary history. Herner

A95-85886
A CONCEPTUAL MODEL OF OVEREXERTION, SAFETY, AND RISK OF INJURY IN OCCUPATIONAL SETTINGS
SHRAWAN KUMAR University of Alberta, Edmonton, Alberta, Canada Human Factors (ISSN 0018-7208) vol. 36, no. 2 June 1994 p. 197-209
(HTN-95-B0070) Copyright

A conceptual generic model for fatigue-mediated overexertion, margin of safety, and job-related risk of injury is proposed. The model has been built with the variables of force, effective exposure in time domain, and motion of the exertion in space. With the proposed model, the physical risk factors can be identified and quantified. It also allows one to guage a relative contribution of various integral factors involved in fatigue-mediated occupational injuries. Although the model is based on established relationships between the job variables (strength (force), frequency-duration of exposure, recovery from exposure, and range of required motion) and the injuries sustaine, it has not been validated within any single sudy. The model provides a framework for numerous validation studies. With availability of more information through such studies, the mode can be appropriately refined for accuracy of its prediction. Author (Herner)

A95-85887
PHYSICAL FATIGUE IN HIGH AND VERY HIGH FREQUENCY MANUAL MATERIALS HANDLING: PERCEIVED EXERTION AND PHYSIOLOGICAL INDICATORS
ANIL MITAL University of Cincinnati, Cincinnati, Ohio, US, HAMID FOONONI-FARD University of Cincinnati, Cincinnati, Ohio, US, and MAX L. BROWN University of Cincinnati, Cincinnati, Ohio, US Human Factors (ISSN 0018-7208) vol. 36, no. 2 June 1994 p. 219-231
(HTN-95-B0071) Copyright

This paper presents the results of a preliminary laboratory study undertaken to determine the perceived exertion and physiological responses of highly trained and experienced workers to high (up to 16 repetitions/min) and very high frequency (above 16 repetitions/min) manual lifting, lowering, and carrying/turning tasks. The results indicate that workers engaged in such highly repetitive and physically demanding tasks may operate at psychophysical workloads that may clearly be considered physically fatiguing and unacceptable according to the current physiological design criteria. In this study subjects performing lifting and lowering tasks, on the average, operated at 57% and 52% of their uphill treadmill aerobic capacity, respectively. For carrying and turning tasks, the average metabolic energy expenditure rate corresponded to 43% of subjects' aerobic capacity. The overall heart rates of the study subjects were 155 beats per minute (bpm) for lifting, 144 bpm for lowering, and 142 bpm for carrying and turning. These physiological responses, when compared with recommended physiological design criteria, are excessively high. The ratings of perceived exertion (RPE) for the shoulder, back, and whole body were highest for lifting (range, 10.20-15.50) and least for carrying and turning (range, 10.30-13.40; carrying and turning activities also including RPE of arms). Generally workers perceived the associated physical exertions as acceptable. Author (Herner)

A95-85888
A LARGE DATABASE STUDY OF THE FACTORS ASSOCIATED WITH WORK-INDUCED FATIGUE
JAY M. FINKELMAN Kelly Temporary Services, Los Angeles, California, US Human Factors (ISSN 0018-7208) vol. 36, no. 2 June 1994 p. 232-243
(HTN-95-B0072) Copyright

A computer survey was conducted using the records of 3705 temporary employees who reported job fatigue during their assignments; 10000 additional employees, who did not report fatigue, were also surveyed in order to establish base rates. Low job challenge, poor-quality supervision, low job control, poor job performance, and low pay rates were associated with employees' experiencing job fatigue. Low physical demand and low information-processing demand positions were also associated with the experience of fatigue, possibly because these variables fell below minimal thresholds necessary to maintain arousal and avoid boredom. The upper portion of the arousal-performance curve was nto properly evaluated in this survey. Fatigue may result from processing too much or too little information. Motivational factors probably serve to moderate this relationship. Author (Herner)

A95-85889
BLINK RATE: A POSSIBLE MEASURE OF FATIGUE
JOHN A. STERN Wahington Unviersity, St. Louis, Missouri, US, DONNA BOYER University of South Dakota, Vermillion, South Dakota, US, and DAVID SCHROEDER FAA/Civil Aeromedical Inst, Oklahoma City, OK, US Human Factors (ISSN 0018-7208) vol. 36, no. 2 June 1994 p. 285-297
(HTN-95-B0073) Copyright

The literature on blink rate as a measure of fatigue is reviewed. The evidence of increases in blink rate as a function of time on task is compelling. However, variables other than time on task also affect blink rate. These variables range from perceptual demandingness of the task to cognitive variables. Other aspects of blinking, such as flurries of blinks, timing with respect to information-processing demands, and blink closure duration, are reviewed as additional variables sensitive to task demands and fatigue effects. Author (Herner)

A95-85890 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
FATIGUE IN OPERATIONAL SETTINGS: EXAMPLES FROM THE AVIATION ENVIRONMENT
MARK R. ROSEKIND NASA Ames Research Center, Moffett Field, California, US, PHILIPPA H. GANDER San Jose State Univesity Foundation, San Jose, California, US, DONNA L. MILLER Sterling Software, KEVIN B. GREGORY Sterling Software,, ROY M. SMITH San Jose State University Foundation, San Jose, California, US, KERI J. WELDON San Jose State University Foundation, San Jose, California, US, ELIZABETH L. CO San Jose State University Foundation, San Jose, California, US, KAREN L. MCNALLY San Jose State University Foundation, San Jose, California, US, and J. VICTOR LEBACQZ NASA Ames Research Center, Moffett Field, California, US Human Factors (ISSN 0018-7208) vol. 36, no. 2 June 1994 p. 327-338
(HTN-95-B0074) Copyright

The need for 24-h operations creates nonstandard and altered work schedules that can lead to cumulative sleep loss and circadian disruption. These factors can lead to fatigue and sleepiness and affect performance and productivity on the job. The approach, research, and results of the NASA Ames Fatigue Countermeasures Program are described to illustrate one attempt to address these issues in the aviation environment. The scientific and operational relevance of these factors is discussed, and provocative issues for future research are presented. Author (Herner)

A95-85891
SPEECH INTELLIGIBILITY AND PROTECTIVE EFFECTIVENESS OF SELECTED ACTIVE NOISE REDUCTION AND CONVENTIONAL COMMUNICATIOS HEADSETS
DANIEL W. GOWER Virginia Polytechninc Institute and State University, Blacksburg, Virginia, and JOHN G. CASALI Virginia Polytechninc Institute and State University, Blacksburg, Virginia, Human Factors (ISSN 0018-7208) vol. 36, no. 2 June 1994 p. 350-367
(HTN-95-B0075) Copyright

An experiment was conducted to compare both speech intelligibility and noise attenuation of a conventional passive headset (David Clark H10-76) and an electronic Active Noise Reduction(ANR) headset (Bose Aviation) operated with and without its ANR feature. Modified Rhyme Tests were conducted in pink and tank noise, and with and without bilateral phase reversal between earphones. The

Bose ANR unit required a significantly higher speech-to-noise (S/N) ratio in both noise environments than the two passive headset systems to maintain equal intelligibility, in part because of its stronger noise reduction and higher required signal level. Articulation Index calculations corroborated the empirical result that the David Clark afforded comparable intelligibility to the Bose ANR device. Bilateral phase reversal proved to be of no benefit, and pink noise proved to be the harsher environment for speech intelligibility. On a speech intelligibility basis alone, the results do not justify the additional cost of the ANR headset; however, when severe noise exposure is at issue, a properly functioning ANR unit may afford more protection than a similar passive headset without electronics, especially in low-frequency noise spectra. Author (Herner)

A95-85926
EFFECTS OF AGING, SKILL MODIFICATION, AND DEMAND ALTERNATION ON MULTIPLE-TASK PERFORMANCE
J. E. HANS KORTELING TNO Human Factors Research Institute, Soesterberg, The Netherlands Human Factors (ISSN 0018-7208) vol. 36, no. 1 March 1994 p. 27-43
(HTN-95-B0110) Copyright

The magnitude of age effects in single- and dual-tasks may be affected by the degree to which performance depends on well-learned skills that were previously developed. In addition, age-effects may be affected by the requirement to modify these skills and by attentional requirements emerging from the mutual relation of subtasks. Effects of skill modification and emergent attentional processes were examined in an experiment in which experienced subjects performed two perceptual-motor tasks, a vehicle steering task and car-following task in a driving simulator. Car-following was performed under two conditions of familiarity, determining whether or not a normal psychomotor routine had to be modified. In dual-task performance, the demand of subtasks was constant or alternating in counterphase. In general, the older subjects' performance did not differ from that of their younger counterparts, except when the single- or dual-task involved routine modification in car-following. Dual-task costs were basically manifested in the car-following task. Author (Herner)

A95-85931
ACCEPTABILITY OF INTERMITTENT HANDGRIP CONTRACTIONS BASED ON PHYSIOLOGICAL RESPONSE
SVEN BYSTROM National Institute of Occupational Health, Stockholm, Swedem and CHARLOTTE FRANSSON-HALL National Institute of Occupational Health, Stockholm, Swedem Human Factors (ISSN 0018-7208) vol. 36, no. 1 March 1994 p. 158-171 Research sponsored by the Swedish Work Environment Fund
(HTN-95-B0115) Copyright

Our aim was to study physiological response and acceptability of intermittent muscle contractions. Seven male subjects performed eight isometric hangrip exercises with altered contraction-relaxation periods but identical tension-time products. Local blood flow (BF), heart rate, blood pressure, electromyography, maximal volunatry handgrip contraction (MVC), and venous concentration of potassium and lactate of both forearms were followed during and up to 24 hours after the exercises. Wrist force response to electrical stimulation of a forearm muscle was used to investigate low-frequency fatigue (LFF). Ratings of perceived exertion were recorded during exercise. LFF was associated with a decreased functional capacity, which may be explained by a net potassium loss. Recovery BF was linearly related to mean contraction intensity of the experiments. Physiological criteria for acceptability of isometric exercise are suggested, based on the absence of fatigue during exercise and the return to baseline values within four hours of the recovery period. Based on these physiological criteria, intermittent handgrip contractions at (or higher than) a mean contraction intensity of 17% MVC and continuous handgrip contractions at (or higher than) 10% MVC were considered unacceptable. Author (Herner)

A95-85932
FAILURE TO FOLLOW SAFETY INSTRUCTIONS: FAULTY COMMUNICATION OR RISKY DECISIONS?
LAWRENCE R. ZEITLIN City University of New York, New York, US Human Factors (ISSN 0018-7208) vol. 36, no. 1 March 1994 p. 172-181
(HTN-95-B0116) Copyright

The faulty communication versus risky decision hypotheses of failure to follow safety instructions were explored in a laboratory experiment. Four groups of 10 male college students differing in tool-using experience and safety orientation were asked to perform work sample activities with an electric chain saw. Safety orientation was provided by classroom lecture content. Dependent variables were compliance with safety warnings contained in the chain saw operating instructions and recognition of those instructions in a posttrial test. Understanding of instructions was verified by posttrial interview. Overall group compliance with the test safety instructions was 55.6%. Compliance for the group experienced with chain saws was 41.25%; for the inexperienced group it was 70%. An analysis of variance (ANOVA) showed both tool experience and safety orientation to be significant in influencing compliance. Instruction recognition was 87.5% overall with no difference between groups. Interviews revealed that the groups made an assessment of subjective risk dependent on their individual experience and safety orientation and acted accordingly. Author (Herner)

A95-85985
NONEQUILIBRIUM DETERMINANTS OF BIOLOGICAL COMMUNITY STRUCTURE
SETH R. REICE Univ. of North Carolina, Chapel Hill, NC, US American Scientist (ISSN 0003-0996) vol. 82, no. 5 September-October 1994 p. 424-435 Research sponsored by the Univ. of North Carolina
(HTN-95-11904) Copyright

The model that has guided policies on ecosystem management and biodiversity issues has ignored important aspects of community dynamics. Human efforts to stabilize ecosystems have resulted in the loss of biodiversity, when the opposite result was the goal. Disturbance should be viewed as both natural and beneficial to the world's biodiversity. This paper demonstrates how disturbance and heterogeneity, not equilibrium, generate biodiversity. Author (Herner)

A95-86248
DNA BINDING COMPOUNDS. 6: SYNTHESIS AND CHARACTERIZATION OF 2,5'-DISUBSTITUTED BIBENZIMIDAZOLES RELATED TO THE DNA MONITOR GROOVE BINDER HOECHST 33258
DAVID P. KELLY University of Melbourne, Parkville, Victoria, Australia, STUART A. BATEMAN University of Melbourne, Parkville, Victoria, Australia, ROBERT J. HOOK University of Melbourne, Parkville, Victoria, Australia, ROGER F. MARTIN Peter MacCallum Cancer Institute, Melbourne, Victoria, Australia, MONICA E. REUM University of Melbourne, Parkville, Victoria, Australia, MICHAEL ROSE University of Melbourne, Parkville, Victoria, Australia, and ANTHONY R. D. WHITTAKER University of Melbourne, Parkville, Victoria, Australia Australian Journal of Chemistry (ISSN 0004-9425) vol. 47, no. 9 1994 p. 1751-1769 Research sponsored by the Australian Research Council and the Anti-Cancer Council of Victoria
(HTN-95-42419) Copyright

A series of compounds have been synthesized in which the basic 2-phenylbibenzimidazole structure of Hoechst 33258 has been modified to include various combinations of bromo, iodo, ethoxy, amino, alkylamino and nitro groups in the terminal phenyl ring. Both sequential and convergent synthetic routes have been followed using coupling reactions of both imino ethers and aldehydes to 1,2-diamines. All these compounds were characterized by a combination of f.a.b. mass spectrometry and H-1 and C-13 nuclear magnetic resonance (n.m.r.) spectroscopy including inverse detection of long-range heteronuclear CH correlations (HMBC). Author (Herner)

A95-86264
NEW GAS-DISCHARGE SOURCES AND DOSIMETERS FOR BACTERICIDAL RADIATION
A. P. ZHEVLAKOV S.I. Vavilov State Optical Inst., St. Petersburg,

Russia, S. A. SOKOLOV S.I. Vavilov State Optical Inst., St. Petersburg, Russia, S. A. TUL'SKII S.I. Vavilov State Optical Inst., St. Petersburg, Russia, T. N. FEDOROVA S.I. Vavilov State Optical Inst., St. Petersburg, Russia, and V. V. YAKOVLEV S.I. Vavilov State Optical Inst., St. Petersburg, Russia Journal of Optical Technology (ISSN 1070-9762) vol. 61, no. 12 December 1994 p. 894-987 Transl. of Opticheskii Zhurnal, vol. 61, no. 12, 1994, p. 49-52
(HTN-95-61165) Copyright

This paper presents the results of developments and studies of new sources and photometers for UV radiation in the bactericidal region of the spectrum. Mechanisms and resources are considered by which enhanced radiation efficiency is achieved in high-power xenon lamps and dosimeters intended for use in UV-irradiation systems. Author (Herner)

N95-26360 Tennessee Univ., Memphis, TN. Dept. of Anatomy and Neurobiology.
RESEARCH ACTIVITIES ON SOMATOSENSORY (SI) CORTICAL NEURONS Annual Report, 1 Jul. 1993 - 30 Jun. 1994
RANDALL J. NELSON 21 Nov. 1994 84 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract(s)/Grant(s): AF-AFOSR-0333-91)
(AD-A288794; AF-AFOSR-0763-94-TR) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

Three research goals were accomplished during this third year. (1) Analysis of data indicated that the responsiveness of primary somatosensory (SI) cortical neurons is 'unattended' if when behavioral conditions become unpredictable. This observation fits with the hypothesis that during stereotyped behavior, neuronal responsiveness is gated so that the CNS may partially engage in other activities. (2) SI cortical neurons that respond to vibratory go-cues for wrist movement with the greatest fidelity have their activity modulated just prior to movement onset. This observation fits with the hypothesis that prior to active movement, sensory inputs that are no longer behaviorally relevant are gated so as not to interfere with monitoring movement parameters by the primate CNS. (3) SI cortical neurons that may bind together other SI neurons with their rhythmic activity have this activity disrupted at go-cue onset and just prior to movement onset. This observation fits with the hypothesis that prior to behaviorally significant events, the activity of these neurons that may tonically gate other SI neurons is suppressed to allow the monitoring sensory events and the initiation of movements. DTIC

N95-26435 Kansas State Univ., Manhattan, KS. Dept. of Pathology and Microbiology.
ANTI-IDIOTYPE PROBES FOR TOXIN DETECTION Final Report, 15 Sep. 1989 - 14 Oct. 1994
JOHN J. IANDOLO and S. K. CHAPES 8 Nov. 1994 373 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract(s)/Grant(s): DAMD17-89-Z-9039)
(AD-A288955) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

This study was designed to investigate the interaction of staphylococcal enterotoxins and exfoliative toxins with leukocytes and to establish baseline information on the consequences of those interactions. Receptor-ligand interactions were characterized and a new non-major histocompatibility complex (MHC) class 2 receptor on the surface of macrophages was discovered. Once these data were at hand, we also prepared an anti-idiotype antibody to class 2 MHC and have used it to inhibit interaction of toxins with their cognate receptor on macrophage surfaces. These studies have resulted in the publication of 31 manuscripts and 7 published abstracts. DTIC

N95-26573 North Carolina State Univ., Raleigh, NC.
BIOCHEMICALLY VULNERABLE SITES FOR ANTIFUNGAL INTERCESSION IN THE CONTROL OF FUNGAL GROWTH Final Report, 1 May 1991 - 30 Apr. 1994
L. W. PARKS 26 Aug. 1994 4 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract(s)/Grant(s): DAAL03-89-D-0003)
(AD-A288345; ARO-29097.3-LS) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

Virtually every antifungal agent in use intercedes some aspect of sterol synthesis or function. Ergosterol is the principal sterol in fungi, while cholesterol is the most abundant sterol in vertebrates. Research in our laboratory has shown that the structural differences in ergosterol, in comparison to cholesterol, have distinctive biochemical and physiological effects in fungi. Under the completed contract we have shown that as the sterol composition of sterol auxotrophic strains of Saccharomyces cerevisiae is altered there is disturbance of the mating efficiency of the strains. The normal sterol, ergosterol, mediates a 30-fold higher productive mating efficiency in the auxotrophs than when the cells are supplied with stigmasterol. Using electron and visible microscopy, we have shown that the mated pairs in stigmasterol remained adherent but prezygotic even after 12 hours incubation. Ergosterol rescued the cells and permitted zygote formation. Based on those experiments it was clear that membrane fusion was perturbed by sterol alterations. Continuing work with the renewal grant is focusing on membrane fusion in various normal cell biological processes. DTIC

N95-26597# Swedish Radiation Protection Inst., Stockholm (Sweden).
RADIATION IN EVERYDAY LIFE
JACK VALENTIN 1993 9 p Presented at the Regional Seminar on Nuclear Energy, A New Energy for Development, Shanghai, China, 1-3 Nov. 1993
(DE95-604111; INIS-MF-14307; CONF-9311250) Avail: CASI HC A02/MF A01 (US Sales Only)

The presentation attempts to provide brief answers to the following questions: what is the cause of radiation? How much radiation are we exposed to? How dangerous is radiation? DOE

N95-26608 Scripps Research Inst., La Jolla, CA.
COFACTOR-ASSISTED ANTIBODY CATALYSIS Final Report, 1 Sep. 1991 - 31 Aug. 1994
DONALD HILVERT 31 Aug. 1994 47 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract(s)/Grant(s): N00014-93-MP-24023)
(AD-A288929) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

This report describes progress made toward the development of cofactor-assisted catalytic antibodies. The development of facile immunoassays for screening large numbers of potential catalysts directly for catalytic activity and their application to libraries of RNA receptors are also discussed. DTIC

N95-26727*# Legacy Good Samaritan Hospital, Portland, OR. Neurological Sciences Inst.
COMPARATIVE TRANSDUCTION MECHANISMS OF VESTIBULAR OTOLITH HAIR CELLS Annual Report, 1 Jan. - 31 Dec. 1994
RICHARD A. BAIRD 31 Dec. 1994 90 p
(Contract(s)/Grant(s): NCC2-651)
(NASA-CR-197980; NAS 1.26:197980) Copyright Avail: CASI HC A05/MF A01

Hair cells in the bullfrog vestibular otolith organs regenerate following aminoglycoside ototoxicity. Hair cells in these organs are differentially sensitive to gentamicin, with saccular hair cells and hair cells in the utricular striola being damaged at lower gentamicin concentrations than hair cells in the utricular extrastriola. Regenerating hair cells in these organs have short hair bundles and can be classified into a number of phenotypes using the same morphological criteria used to identify their mature counterparts. Our studies suggest that some supporting cells can convert, or transdiffer-

entiate,into hair cells without an intervening cell division. By stimulating these processes in humans, clinicians may be able to alleviate human deafness and peripheral vestibular disorders by regenerating and replacing lost hair cells. In vivo and in vitro studies were done on cell proliferation and hair cell regeneration. For individual titles, see N95-26728 through N95-26732.

N95-26728*# Legacy Good Samaritan Hospital, Portland, OR. Neurological Sciences Inst.

REGIONAL DIFFERENCES IN LECTIN BINDING PATTERNS OF VESTIBULAR HAIR CELLS

RICHARD A. BAIRD, N. R. SCHUFF, and J. BANCROFT *In its* Comparative Transduction Mechanisms of Vestibular Otolith Hair Cells 13 p 31 Dec. 1994 Sponsored by National Inst. of Deafness and Communicative Disorders, and Oregon Lions Sight and Hearing Foundation Repr. from Hearing Research (New York, NY, Elsevier Science Publishers B.V.), v. 65, 1993 p 151-163

(ISSN 0378-5955) Avail: CASI HC A03/MF A01

Surface glycoconjugates of hair cells and supporting cells in the vestibular endorgans of the bullfrog were identified using biotinylated lectins with different carbohydrate specificities. Lectin binding in hair cells was consistent with the presence of glucose and mannose (CON A), galactose (RCA-I), N-acetylgalactosamine (VVA), but not fucose (UEA-I) residues. Hair cells in the bullfrog sacculus, unlike those in the utriculus and semicircular canals, did not stain for N-acetylglucosamine (WGA) or N-acetylgalactosamine (VVA). By contrast, WGA and, to a lesser extent, VVA, differentially stained utricular and semicircular canal hair cells, labeling hair cells located in peripheral, but not central, regions. In mammals, WGA uniformly labeled Type 1 hair cells while labeling, as in the bullfrog, Type 2 hair cells only in peripheral regions. These regional variations were retained after enzymatic digestion. We conclude that vestibular hair cells differ in their surface glycoconjugates and that differences in lectin binding patterns can be used to identify hair cell types and to infer the epithelial origin of isolated vestibular hair cells. Author

N95-26729*# Legacy Good Samaritan Hospital, Portland, OR. Neurological Sciences Inst.

HAIR CELL REGENERATION IN THE BULLFROG VESTIBULAR OTOLITH ORGANS FOLLOWING AMINOGLYCOSIDE TOXICITY

RICHARD A. BAIRD, M. A. TORRES, and N. R. SCHUFF *In its* Comparative Transduction Mechanisms of Vestibular Otolith Hair Cells 11 p 31 Dec. 1994 Sponsored by National Inst. of Deafness and communicative Disorders, and Oregon Lions Sight and Hearing Foundation Repr. from Hearing Research (New York, NY, Elsevier Science Publishers B.V.), v. 65, 1993 p 164-174

Avail: CASI HC A01/MF A01

Adult bullfrogs were given single intraotic injections of the aminoglycoside antibiotic gentamicin sulfate and sacrificed at postinjection times ranging from 0.5 to 9 days. The saccular and utricular maculae of normal and injected animals were examined in wholemount and cross-section. Intraotic 200 (mu) M gentamicin concentrations resulted in the uniform destruction of the hair bundles and, at later times, the cell bodies of saccular hair cells. In the utriculus, striolar hair cells were selectively damaged while extrastriolar hair cells were relatively unaffected. Regenerating hair cells, identified in sectioned material by their small cell bodies and short, well-formed hair bundles, were seen in the saccular and utricular maculae as early as 24-48 h postinjection. Immature versions of mature hair cell types in both otolith organs were recognized by the presence of absence of a bulbed kinocilia and the relative lengths of their kinocilia and longest sterocilia. Utricular hair cell types with kinocilia longer than their longest stereocilia were observed at earlier times than hair cell types with shorter kinocilia. In the same sacculus, the hair bundles of gentamicin-treated animals, even at 9 days postinjection, were significantly smaller than those of normal animals. The hair bundles of utricular hair cells, on the other hand, reached full maturity within the same time period. Author

N95-26730*# Legacy Good Samaritan Hospital, Portland, OR. Dept. of Neuro-otology.

PERIPHERAL INNERVATION PATTERNS OF VESTIBULAR NERVE AFFERENTS IN THE BULLFROG UTRICULUS

RICHARD A. BAIRD and N. R. SCHUFF *In its* Comparative Transduction Mechanisms of Vestibular Otolith Hair Cells 20 p 31 Dec. 1994 Sponsored by National Inst. of Deafness and Communicative Disorders, and Oregon Lions Sight and Hearing Foundation Repr. from The Journal of Comparative Neurology (New York, NY, Wiley-Liss, Inc.), v. 342, 1994 p 279-298

Avail: CASI HC A03/MF A01

Vestibular nerve afferents innervating the bullfrog utriculus differ in their response dynamics and sensitivity to natural stimulation. They also supply hair cells that differ markedly in hair bundle morphology. To examine the peripheral innervation patterns of individual utricular afferents more closely, afferent fibers were labeled by the extracellular injection of horseradish peroxidase (HRP) into the vestibular nerve after sectioning the vestibular nerve medial to Scarpa's ganglion to allow the degeneration of sympathetic and efferent fibers. The peripheral arborizations of individual afferents were then correlated with the diameters of their parent axons, the regions of the macula they innervate, and the number and type of hair cells they supply. The utriculus is divided by the striola, a narrow zone of distinctive morphology, into media and lateral parts. Utricular afferents were classified as striolar or extrastriolar according to the epithelial entrance of their parent axons and the location of their terminal fields. In general, striolar afferents had thicker parent axons, fewer subepithelial bifurcations, larger terminal fields, and more synaptic endings than afferents in extrstriolar regions. Afferents in a juxtastriolar zone, immediately adjacent to the medial striola, had innervation patterns transitional between those in the striola and more peripheral parts of the medial extrastriola. moast afferents innervated only a single macular zone. The terminal fields of striolar afferents, with the notable exception of a few afferents with thin parent axons, were generally confined to one side of the striola. Hair cells in the bullfrog utriculus have perviously been classified into four types based on hair bundle morphology. Afferents in the extrastriolar and juxtastriolar zones largely or exclusively innervated Type B hair cells, the predominant hair cell type in the utricular macula. Striolar afferents supplied a mixture of four hair cell types, but largely contacted Type B and Type C hair cells, particularly on the outer rows of the medial striola. Afferents supplying more central striolar regions innervated fewer Type B and larger numbers of Type E and Type F hair cells. Striolar afferents with thin parent axons largely supplied Type E hair cells with bulbed kniocilia in the innermost striolar rows. Author

N95-26731*# Legacy Good Samaritan Hospital, Portland, OR. Dept. of Neuro-otology.

COMPARATIVE TRANSDUCTION MECHANISMS OF HAIR CELLS IN THE BULLFROG UTRICULUS. 1: RESPONSES TO INTRACELLULAR CURRENT

RICHARD A. BAIRD *In its* Comparative Transduction Mechanisms of Vestibular Otolith Hair Cells 19 p 31 Dec. 1994 Sponsored by National Inst. of Deafness and Communicative Disorders, and Oregon Lions Sight and Hearing Foundation Repr. from Journal of Neurophysiology (Bethesda, MD, The American Physiological Society), v. 71, no. 2, Feb. 1994 p 666-683

Avail: CASI HC A03/MF A01

Hair cells in the bullfrog sacculus are specifically adapted to sense small-amplitude, high-frequency linear accelerations. These hair cells display many properties that are undesirable or inappropriate for hair cells that must provide static gravity sensitivity. This study resulted in part due to an interest in seeing how the transduction mechanisms of hair cells in a gravity-sensing otolith endorgan would differ from those in the bullfrog sacculus. The bullfrog utriculus is an appropriate model for these studies, because its structure is

representative of higher vertebrates in general and its function as a sensor of static gravity and dynamic linear acceleration is well known. Hair cells in the bullfrog utriculus, classifiable as Type 2 by cell body and synapse morphology, differ markedly in hair bundle morphology from those in the bullfrog sacculus. Moreover, the hair bundle morphologies of utricular hair cells, unlike those in the sacculus, differ in different membrane regions. Derived from text

N95-26732*# Legacy Good Samaritan Hospital, Portland, OR. Dept. of Neuro-otology.
COMPARATIVE TRANSDUCTION MECHANISMS OF HAIR CELLS IN THE BULLFROG UTICULUS. 2: SENSITIVITY AND RESPONSE DYNAMICS TO HAIR BUNDLE DISPLACEMENT
RICHARD A. BAIRD *In its* Comparative Transduction Mechanisms of Vestibular Otolith Hair Cells 21 p 31 Dec. 1994 Sponsored by National Inst. of Deafness and Communicative Disorders, and Oregon Lions Sight and Hearing Foundation Repr. from Journal of Neurophysiology (Bethesda, MD, The American Physiological Society), v. 71, no. 2, Feb. 1994 p 685-705
Avail: CASI HC A03/MF A01

The present study was motivated by an interest in seeing whether hair cell types in the bullfrog utriculus might differ in their voltage responses to hair bundle displacement. Particular interest was in assessing the contributions of two factors to the responses of utricular hair cells. First, interest in examining the effect of hair bundle morphology on the sensitivity of hair cells to natural stimulation was motivated by the observation that vestibular hair cells, unlike many auditory hair cells, are not free-standing but rather linked to an accessory cupular or otolithic membrane via the tip of their kinocilium. Interest also laid in examining the contribution, if any, of adaptation to the response properties of utricular hair cells. Hair cells in auditory and vibratory inner ear endorgans adapt to maintained displacements of their hair bundles, sharply limiting their low frequency sensitivity. This adaptation is mediated by a shift in the displacement-response curve (DRC) of the hair cell along the displacement axis. Observations suggest that the adaptation process occurs within the hair bundle and precedes mechanoelectric transduction. Recent observations of time-dependent changes in hair bundle stiffness are consistent with this conclusion. Adaptation would be expected to be most useful in inner ear endorgans in which hair cells are subject to large static displacements that could potentially saturate their instantaneous response and compromise their sensitivity to high frequency stimulation. The adaptation process also permits hair cells to maintain their sensory hair bundle in the most sensitive portion of their DRC. In vestibular otolith organs in which static sensitivity is desirable, any adaptation process in the hair cells may be undesirable. The rate and extent of the decline of the voltage responses was measured of utricular hair cells to step and sinusoidal hair bundle displacements. Then for similar resting potentials and response amplitudes, the voltage responses of individual hair cells were compared to both hair bundle displacement and intracellular current. Derived from text

N95-26761 Arizona Univ., Tucson, AZ.
A MODEL OF THE NEURAL BASIS OF THE RAT'S SENSE OF DIRECTION
WILLIAM E. SKAGGS, JAMES J. KNIERIM, and HEMANT S. KUDRIMOTI 1994 8 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(AD-A289678) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

In the last decade the outlines of the neural structures subserving the sense of direction have begun to emerge. Several investigations have shed light on the effects of vestibular input and visual input on the head direction representation. In this paper, a model is formulated of the neural mechanisms underlying the head direction system. The model is built out of simple ingredients, depending on nothing more complicated than connectional specificity, attractor dynamics, Hebbian learning and sigmoidal nonlinearities, but it behaves in a sophisticated way and is consistent with most of the observed properties of real head direction cells. In addition it makes a number of predictions that ought to be testable by reasonably straightforward experiments. DTIC

N95-27097 Seattle City Light, WA.
DIAGNOSTIC ANTIGENS OF LEISHMANIA Final Report
STEVEN G. REED 31 Jan. 1994 20 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract(s)/Grant(s): DAMD17-92-C-2082)
(AD-A288805) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

We report herein the cloning, expression, and seroreactivity of three Leishmania tropica antigens. By ELISA analysis, the majority of confirmed and suspected viscerotropic leishmaniasis patients had significantly higher levels of specific antibody against two of the three recombinant antigens and the repeat portion of one of the antigens, named Lt-lr, when compared to sera from normal controls. The molecular characterization of these two antigens demonstrated that these are adjacent portions of the same gene and that the repeat portion contains one of the immunodominant epitopes. In addition, this gene was shown to be conserved in all strains of L. tropica parasites recovered from Gulf War participants. The gene does not appear to be highly conserved among all species of Leishmania. Collectively, the data indicate the potential for these antigens to assist in the diagnosis of individuals with viscerotropic leishmamasis. DTIC

N95-27100 Arizona Univ., Tucson, AZ. Research Lab.
HIPPOCAMPAL PLACE FIELDS, THE INTERNAL COMPASS, AND THE LEARNING OF LANDMARK STABILITY
JAMES J. KNIERIM, HEMANT S. KUDRIMOTI, and BRUCE L. MCNAUGHTON 16 May 1994 48 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract(s)/Grant(s): N00014-90-J-1869)
(AD-A289406) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

Previous studies have shown that hippocampal place fields are controlled by the salient sensory cues in the environment, in that rotation of the cues causes an equal rotation of the place fields. We trained rats to forage for food pellets in a gray cylinder with a single salient directional cue, a white card covering 900 of the wall. Half of the rats were disoriented before being placed in the cylinder, in order to disrupt their internal sense of direction. The other half were not disoriented before being placed in the cylinder; for these rats, there was presumably a consistent relationship between the cue card and their internal direction sense. We subsequently recorded hippocampal place cells and thalamic head direction cells from both groups of rats as they moved in the cylinder, between some sessions the cylinder and cue card were rotated to a new direction. All rats were disoriented before recording. Under these conditions, the cue card had much weaker control over the place fields and head direction cells in the rats that had been disoriented during training than in the rats that had not been disoriented. For the former group, the place fields often rotated relative to the cue card or completely changed their firing properties between sessions. In all recording sessions, the head direction cells and place cells were strongly coupled. It appears that the strength of cue control over place cells and head direction cells depends on the rat's learned perception of the stability of the cues. DTIC

N95-27254# International Centre for Theoretical Physics, Trieste (Italy).
THE ELECTRICAL BEHAVIOUR OF AN EXCITABLE CELL AT DIFFERENT CONDITIONS
M. EL-SAYED and A. M. MOHAMMED Aug. 1994 23 p
(DE95-607911; IC-94/232) Avail: CASI HC A03/MF A01

The Hodgkin-Huxley, H-H, model has been modified, in this work, to study the electrical behaviour of an excitable cell due to changes in the permeability of K and Na ions (g(sub k) and g(sub Na)), the simultaneous stochastic variations of g(sub k) and g(sub Na), the current stimulus (Jstim) and the non-inactivation of Na-

channel (NI - NaC). The amplitude and duration of the generated action potential (AP) was found to increase as g(sub k) increases, with the appearance of repetitive AP spikes in the range of 21.5 (greater than or equal to) g(sub k) (greater than or equal to) 3.5 while the K- and Na-currents (J(sub k) and J(sub Na)) showed a pronounced decrease. On the other hand, the increase of g(sub Na) was accompanied by an increase in AP amplitudes and durations and also in J(sub k) and J(sub Na) with the appearance of a repetitive AP at 1400 (greater than or equal to) g(sub Na) (greater than or equal to) 189 ms/sq cm whose frequency increases with the increase of g(sub Na). Moreover, the stochastic variations in g(sub k) and g(sub Na) could generate a repetitive AP whose frequency could be changed either by changing the values of g(sub k) or g(sub Na) or both, and may represent an information carried by the sensory cells for example. The electrical behaviour of the simulated cell can also be affected by Jstim at different values of g(sub k) except at the range of 21.5 (greater than or equal to) g(sub k) (greater than or equal to) 3.5 ms/sq cm and also depended on NI - NaC fraction. DOE

N95-27329*# Benson (Robert H.), Springfield, VA.
MICROGRAVITY SCIENCES BIOTECHNOLOGY FACILITY ASSESSMENT Final Report, 15 Feb. - 29 Mar. 1995
ROBERT H. BENSON 29 Mar. 1995 48 p
(Contract(s)/Grant(s): NASA ORDER H-24601-D)
(NASA-CR-196602; NAS 1.26:196602; MSFC-2) Avail: CASI HC A03/MF A01

This report provides an assessment of the risks of the Biotechnology Facility being developed at the Johnson Space Center for flight on the International Space Station. The assessment includes technical status, schedules, budgets, project management, performance of facility relative to science requirements, and identifies risks and issues that need to be considered in future development activities. Author

N95-27725# Lawrence Livermore National Lab., Livermore, CA.
AUTOMATED INTEGRATION OF GENOMIC PHYSICAL MAPPING DATA VIA PARALLEL SIMULATED ANNEALING
T. SLEZAK Jun. 1994 19 p Presented at the 3d International Conference on Bioinformatics and Genome Research, Tallahassee, FL, 1-4 Jun. 1994
(Contract(s)/Grant(s): W-7405-ENG-48)
(DE95-008057; UCRL-JC-117666; CONF-9406311-1) Avail: CASI HC A03/MF A01

The Human Genome Center at the Lawrence Livermore National Laboratory (LLNL) is nearing closure on a high-resolution physical map of human chromosome 19. We have build automated tools to assemble 15,000 fingerprinted cosmid clones into 800 contigs with minimal spanning paths identified. These islands are being ordered, oriented, and spanned by a variety of other techniques including: Fluorescence Insitu Hybridization (FISH) at 3 levels of resolution, ECO restriction fragment mapping across all contigs, and a multitude of different hybridization and PCR techniques to link cosmid, YAC, AC, PAC, and Pl clones. The FISH data provide us with partial order and distance data as well as orientation. We made the observation that map builders need a much rougher presentation of data than do map readers; the former wish to see raw data since these can expose errors or interesting biology. We further noted that by ignoring our length and distance data we could simplify our problem into one that could be readily attacked with optimization techniques. The data integration problem could then be seen as an M x N ordering of our N cosmid clones which 'intersect' M larger objects by defining ' intersection' to mean either contig/map membership or hybridization results. Clearly, the goal of making an integrated map is now to rearrange the N cosmid clone 'columns' such that the number of gaps on the object 'rows' are minimized. Our FISH partially-ordered cosmid clones provide us with a set of constraints that cannot be violated by the rearrangement process. We solved the optimization problem via simulated annealing performed on a network of 40+ Unix machines in parallel, using a server/client model built on explicit socket calls. For current maps we can create a map in about 4 hours on the parallel net versus 4+ days on a single workstation. Our biologists are now using this software on a daily basis to guide their efforts toward final closure. DOE

N95-27948# Argonne National Lab., IL.
ENERGY TRANSFER IN REAL AND ARTIFICIAL PHOTOSYNTHETIC SYSTEMS
J. C. HINDMAN, J. E. HUNT, and J. J. KATZ 1995 23 p
(Contract(s)/Grant(s): W-31-109-ENG-38)
(DE95-005824; ANL/CHM/PP-80864) Avail: CASI HC A03/MF A01

Fluorescence emission from the photosynthetic organisms Tribonema aequale, Anacystis nidulau, and Chlorelia vulgais and from some chlorophyll model systems have been recorded as a function of excitation wavelength and temperature. Considerable similarity was observed in the effects of excitation wavelength and temperature on the fluorescence from intact photosynthetic organisms and the model systems. The parallelism in behavior suggest that self-assembly processes may occur in both the in vivo and in vitro systems that give rise to chlorophyll species at low temperature that may differ significantly from those present at ambient temperatures. DOE

N95-28177*# California Univ., Berkeley. Lawrence Berkeley Lab, CA.
MUTAGENESIS IN HUMAN CELLS WITH ACCELERATED H AND FE IONS Final Report, May 1991 - Apr. 1994
AMY KRONENBERG Apr. 1994 12 p
(Contract(s)/Grant(s): NASA ORDER T-9309-R)
(NASA-CR-198599; NAS 1.26:198599) Avail: CASI HC A03/MF A01

The overall goals of this research were to determine the risks of mutation induction and the spectra of mutations induced by energetic protons and iron ions at two loci in human lymphoid cells. During the three year grant period the research has focused in three major areas: (1) the acquisition of sufficient statistics for human TK6 cell mutation experiments using Fe ions (400 MeV/amu), Fe ions (600 MeV/amu) and protons (250 MeV/amu); (2) collection of thymidine kinase- deficient (tk) mutants or hypoxanthine phosphoribosyltransferase deficient (hprt) mutants induced by either Fe 400 MeV/amu, Fe 600 MeV/amu, or H 250 MeV/amu for subsequent molecular analysis; and (3) molecular characterization of mutants isolated after exposure to Fe ions (600 MeV/amu). As a result of the shutdown of the BEVALAC heavy ion accelerator in December 1992, efforts were rearranged somewhat in time to complete our dose-response studies and to complete mutant collections in particular for the Fe ion beams prior to the shutdown. These goals have been achieved. A major effort was placed on collection, re-screening, and archiving of 3 different series of mutants for the various particle beam exposures: tk-ng mutants, tk-sg mutants, and hprt-deficient mutants. Where possible, groups of mutants were isolated for several particle fluences. Comparative analysis of mutation spectra has occured with characterization of the mutation spectrum for hprt-deficient mutants obtained after exposure of TK6 cells to Fe ions (600 MeV/amu) and a series of spontaneous mutants. Author

N95-28298 Radian Corp., Austin, TX.
USE OF MUSSELS IN BIOMONITORING OF ENVIRONMENTAL IMPACTS OF PROPELLANTS, PROJECTILES, EXPLOSIVES, AND PYROTECHNICS
J. HIXSON, R. JENNINGS, and C. H. STAGG (Joint Readiness Training Center, Fort Polk, LA.) *In* Johns Hopkins Univ., The 1994 JANNAF Safety and Environmental Protection Subcommittee Meeting, Volume 1 p 33-42 Aug. 1994
Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

The primary mission of the Ft. Polk Military Reservation is to provide a base of operations for the Joint Readiness Training Center (JRTC). Army and Air Force contingency forces conduct joint training operations at the JRTC which replicate, as closely as possible, those of real low- and mid-intensity conflicts. The reserva-

tion operates an open burning/open detonation (OB/OD) unit primarily to treat unserviceable ammunition and explosives generated as a result of routine training operations. The unit is located in a national forest, and consequently there has been concern regarding potential impacts of OB/OD activities on wildlife. The U.S. Forest Service (the site owner) requested that an environmental assessment be performed for the unit to evaluate these potential impacts. The entire military reservation, including the OB/OD unit, is located in an area with numerous wetlands and streams. Based on a prior investigation of limited scope, there was some concern that activities at the reservation may have adversely impacted aquatic invertebrates. It was decided that a biomonitoring study should be conducted to clarify the results of the previous investigation and to determine the contribution of the activities on the reservation to downstream population effects. The biomonitoring study was designed to be performed in two stages. The first stage, discussed in this paper, was a screening analysis to determine whether specific chemicals were present in mussels within and downstream of the reservation. This stage will be followed with a more detailed analysis including population studies as well as chemical analyses of biota collected from multiple locations. Author

N95-28496# International Society for Photogrammetry, London (England).
THIRD INTERNATIONAL CONGRESS OF PLANT MOLECULAR BIOLOGY: MOLECULAR BIOLOGY OF PLANT GROWTH AND DEVELOPMENT
RICHARD B. HALLICK, ed. 1995 421 p Congress held in Tucson, AZ, 6-11 Oct. 1991
(Contract(s)/Grant(s): DE-FG09-90ER-20012)
(DE95-006482; CONF-9110552-ABSTS) Avail: CASI HC A18/MF A04

The Congress was held 6-11 Oct. 1991 in Tucson with approximately 3000 scientists attending and over 300 oral presentations and 1800 posters. Plant molecular biology is one of the most rapidly developing areas of the biological sciences. Recent advances in the ability to isolate genes, to study their expression, and to create transgenic plants have had a major impact on our understanding of the many fundamental plant processes. In addition, new approaches have been created to improve plants for agricultural purposes. This is a book of presentation and posters from the conference. DOE

N95-28519 Naval Postgraduate School, Monterey, CA. Dept. of Operations Research.
MODELING AND STATISTICAL ANALYSIS OF BIOASSAY DATA: MEDAKA CELL PROLIFERATION UNDER DEN AND TCE Technical Report
DONALD P. GAVER and PATRICIA A. JACOBS Oct. 1994 48 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(AD-A289998; NPS-OR-94-014) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

The response of medaka liver to the chemicals DEN and TCE is analyzed statistically. The analysis illustrates the application of methods useful in environmetrics, i.e. environmental statistics. It suggests an overall dose-response effect but not an easily-interpreted dose-response functional relationship. DTIC

N95-28525 Virginia Univ., Charlottesville, VA.
DEVELOPMENT AND APPLICATION OF LOW-TEMPERATURE AFM Final Report, 1 Nov. 1991 - 31 Oct. 1994
JIE YANG and ZHIFENG SHAO 30 Jan. 1995 19 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract(s)/Grant(s): DAAL03-92-G-0002)
(AD-A291704; ARO-29194.9-LS) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

With the support from the US Army Research Office, we have established the basis of using state-of-the-art atomic force microscope (AFM) to image biological specimens at sub-nm resolution at cryogenic temperatures under ambient pressure. Our instrumentation demonstrated convincingly that a contamination environment can be obtained as we proposed originally, and the performance of our prototype AFM at cryogenic temperatures was at least comparable to, if not better than, any atomic force microscope available today. We have also developed various methods to facilitate atomic force microscopy of biological specimens at room temperature. Modification of the Kleinschmidt methods enabled us to image DNA specimens in air at a resolution of 4-6 nm. Reliable preparation of supported bilayers enabled us to study the structure of lipid bilayers in situ, leading to the elucidation of interesting phenomena which are impossible to reveal by other available methods, and the imaging of membrane proteins in physiological conditions at a resolution of 1 nm. We also developed methods to image soluble proteins in solution at a resolution of 1 nm. These suggest strongly the usefulness of AFM in biology that it can be used to solve problems which are difficult to tackle with other methods. DTIC

N95-28546 Florida Univ., Gainesville, FL.
INTERNATIONAL JOURNAL OF QUANTUM CHEMISTRY Final Report, 1 Jan. - 31 Dec. 1994
RODNEY J. BARTLETT Feb. 1995 253 p Presented at the 21st Quantum Biology Symposium, Ponte Verda Beach, FL, 12-19 Feb. 1994 Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract(s)/Grant(s): DAAH04-94-G-0015)
(AD-A291633; ARO-32557.1-PH-CF) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

The 34th Annual Sanibel Symposium, organized by the faculty and staff of the Quantum Theory Project of the University of Florida, was held on February 12-19, 1994, at the Marriott, Sawgrass Resort, Ponte Vedra Beach, Florida. Over 300 participants gathered for 8 days of lectures and informal discussions. The format of the symposium adopted for the past few years was followed again this year with a compact 8-day schedule with an integrated program of quantum biology, quantum chemistry, and condensed matter physics. The topics of the sessions covered by these proceedings include Quantum Chemistry of Biological Molecules, Spectroscopic Signatures of Biological Molecules, Protein Folding, and Photosynthesis. DTIC

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AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

A95-82602* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
RADIATION HEALTH FOR A MARS MISSION
DONALD E. ROBBINS NASA. Johnson Space Center, Houston, TX, US In International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 2039-2046 Copyright

Uncertainties in risk assessments for exposure of a Mars mission crew to space radiation place limitations on mission design and operation. Large shielding penalties are imposed in order to obtain acceptable safety margins. Galactic cosmic rays (GCR) and solar particle events (SPE) are the major concern. A warning system and 'safe-haven' are needed to protect the crew from large SPE which produce lethal doses. A model developed at NASA Johnson Space Center (JSC) to describe solar modulation of GCR intensities reduces that uncertainty to less than 10 percent. Radiation transport models used to design spacecraft shielding have large uncertainties in nuclear fragmentation cross sections for GCR which interact with spacecraft materials. Planned space measurements of linear energy transfer (LET) spectra behind various shielding thicknesses will

reduce uncertainties in dose-versus-shielding thickness relationships to 5-10 percent. The largest remaining uncertainty is in biological effects of space radiation. Data on effects of energetic ions in human are nonexistent. Experimental research on effects in animals and cell is needed to allow extrapolation to the risk of carcinogenesis in humans. Author (Herner)

A95-82603
EFFECTS OF LATERAL TILT ON OPTOKINETIC NYSTAGMUS, AFTERNYSTAGMUS, AND EYE TRACKING IN HUMANS
HIROYUKI SUZUKI Nagoya Univ., Nagoya, Japan and SATORU WATANABE Nagoya Univ., Nagoya, Japan *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 2047-2051
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We examined the otolith input influence on both horizontal optokinetic nystagmus (OKN) and subsequent optokinetic afternystagmus (OKAN) using a large-field optikinetic stimulation with constant acceletation combined with a static change of position using a tilting-bed. Subjects faced a dome-screen 1.5 m in diameter. All subjects, while mounting a 1.15 m tilting-bed, were tilted laterally from their upright position to a 45 deg, 90 deg, and supine position. Horizontal optokinetic stimuli were projected on the screen 4 times at each tilting position (rightward or leftward alternately). One stimulus accelerated form 0 deg to 80 deg/sec over a 20 s period. The second stimulus accelerated for 0 deg to 160 deg/sec over a 40 s period. The uniform velocity for both was 4 deg/sec(exp 2). The stimulus profile was immediately followed by 60 s of darkness for OKAN recording. In order to compare these results with pursuit eye movement, the subjects tracked a spot oscillating sinusoidally (0.2, 0.5, 0.75, 1.0 Hz) with an amplitude of a 20 deg wave. Horizontal the ENG recorded were extracted to slow phase and converted to velocity waveform. With the pursuit tracking, the amplitude gains were almost equal between the 6 positions, and when stimulus velocity was increased, the gains in all positions were decreased accordingly. On the other hand, with optokinetic stimulation, the optokinetic 'break-off point' of slow phase, where the velocity of eye movement did not follow the stimulus velocity, was highest in the upright position and decreased in all other tilting positions. Both the OKAN duration and the time-constant of its slow phase decay also decreased with tilting positions. We can conclude that otolith inputs influence on optokinetic nystagmus generation, and affect retinal nystagmus to a greater extent than foveal nystagmus. Author (Herner)

A95-82604* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
RESPONSES OF HEART RATE AND BLOOD PRESSURE TO KC-135 HYPER-GRAVITY
HIROTAKA SATAKE Gifu Univ., Gifu, Japan, KEN'ICHI MATSUNAMI Gifu Univ., Gifu, Japan, and MILLARD F. RESCHKE NASA. Johnson Space Center, Houston, TX, US *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 2053-2058
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Many investigators have clarified the effects of hyper gravitational-inertial forces (G) upon the cardiovascular system, using the centrifugal apparatus with short rotating radius. We investigated the cardiovascular responses to KC-135 hyper-G flight with negligibly small angular velocity. Six normal, healthy subjects 29 to 40 years old (5 males and 1 female) took part in this experiment. Hyper gravitational-inertial force was generated by the KC-135 hyper-G flight, flown in a spiral path with a very long radius of 1.5 miles. Hyper-G was sustained for 3 minutes with 1.8 +Gz in each session and was repeatedly exposed to very subject sitting on a chair 5 times. The preliminary results of blood pressure and R-R interval are discussed. An exposure of 1.8 +Gz stress resulted in a remarkable increase of systolic and diastolic blood pressure, while the pulse pressure did not change and remained equal to the control level regardless of an exposure of hyper-G. These results in blood pressure indicate an increase of resistance in the peripheral vessels, when an exposure of hyper-G was applied. The R-R interval was calculated from ECG. R-R interval in all subjects was changed but not systematically, and R-R interval became obviously shorter during the hyper-G period than during the 1 +Gz control period although R-R interval varied widely in some cases. The coefficient of variation of R-R interval was estimated to determine the autonomic nerve activity, but no significant change was detectable. Author (Herner)

A95-82615
OVERLOADS INFLUENCE ON COSMONAUT'S REACTION RATE
V. PRISNIAKOV State Univ., Ukraine and L. PRISNIAKOVA State Univ., Ukraine *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 2121-2124
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The astronaut's fitness to work within the load factor field is influenced first of all by the factors connected with man's visual and motor characteristics. The formula for brightness threshold determination R(sub 0) has been obtained on the basis of the differential equation solution of the preservation of the forthcoming information flow to the cosmonaut's memory. This formula give the possibility of evaluating the overload influence on the main parameters value T and phi, which depend also on load factors bar j = j/g(sub 0). Author (Herner)

A95-83162
THE GREAT LUNAR QUARANTINE
BRIAN DUFF Air & Space Smithsonian (ISSN 0886-2257) vol. 8, no. 6 February-March 1994 p. 38-43
(HTN-95-A0582) Copyright

An historical account of the Apollo 11, 12, and 14 astronauts' post-mission quarantine is presented. They were isolated in an attempt to protect the Earth from possible contamination of destructive alien organisms. Equipment, policy, procedures, and various quarantine experiences are discussed. Herner

A95-85336
EFFECTS OF LOW BLOOD ALCOHOL LEVELS ON PILOTS' PRIORITIZATION OF TASKS DURING A RADIO NAVIGATION TASK
FIONA J. SMITH Cranfield University, Bedfordshire, UK and DON HARRIS Cranfield University, Bedfordshire, UK International Journal of Aviation Psychology (ISSN 1050-8414) vol. 4, no. 4 Spring p. 349-358
(HTN-95-92292) Copyright

Eight pilots flew a specified cross-country route using radio navigation in a flight simulator with simulated air traffic control. Four of the pilots flew with a low blood alcohol level (BAL; mean BAL = 20.63 mg%). Pilots' performance was compared in terms of flying performance, navigation, and radio communication. We hypothesized that the tasks most likely to be shed as a result of alcohol impairment would be those lower down in the task prioritization hierarchy of 'aviate, navigate and communicate.' This hypothesis was supported; alcohol was found to impair significantly pilots' radio communication. Results are discussed with reference to the piloting task and the implications for alcohol regulation in aviation. Author (Herner)

N95-26494 Army Medical Dept. Center and School, Fort Sam Houston, TX. Center for Healthcare Education and Studies.
DEVELOPMENT OF AN ACUITY-BASED NURSE STAFFING SYSTEM FOR THE POST ANESTHESIA CARE UNIT Final Report, 1992 - 1993
JULIE K. ZADINSKY Nov. 1994 143 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(AD-A288831; HR95-001) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

The purposes of the study were (1) to provide an acuity-based

method of determining nurse staffing needs for post anesthesia care units (PACU's) in the Army Medical Department (AMEDD) and (2) to provide a method of analyzing PACU workload variation. This method of determining staffing needs and analyzing workload variation is known as the Post Anesthesia Care Staffing System (PACS). Data were collected using (1) the PACU acuity worksheet at six study sites for a 16-week period, (2) records of nursing hours worked when the acuity information was being collected, and (3) a survey of PACU characteristics sent to 39 Army PACU's in the U.S. Army Health Services Command (HSC, now the U.S. Army Medical Command or MEDCOM). The strong positive correlation (r greater than .90) between daily direct nursing care hours and patient volume supported the development of a general regression model that was used to estimate daily direct nursing care hours from patient volume information. DTIC

N95-26680 Mayo Foundation, Rochester, MN.
MECHANISMS OF HYPERTENSION AFTER CROSS-LINKED HEMOGLOBIN BLOOD-SUBSTITUTE TRANSFUSION Midterm Report
MICHAEL J. JOYNER 1 Dec. 1994 19 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract(s)/Grant(s): DAMD17-93-C-3116)
(AD-A289558) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

The USAMRDC has developed a 'blood substitute' containing cross-linked human hemoglobin (XL-Hgb) in a physiologic saline solution. In animal models, this material can sustain life in the absence of red blood cells and is effective in resuscitating experimental animals from hypovolemic hemorrhagic shock. A persistent side-effect of XL-Hgb administration in animals has been marked arterial and pulmonary hypertension. The mechanism of this hypertension is unknown, but it is hypothesized that the XL-Hgb scavenges the endogenous vasodilating substance nitric oxide (NO). In experiments to date, our group has demonstrated that XL-Hgb administration (1) appears to blunt NO-mediated vasodilation in isolated blood vessels; (2) disrupts the normal metabolism of catecholamines from the adrenal medulla and sympathetic nerve endings; (3) blunts NO-mediated vasodilation in vivo; and (4) causes acute volume expansion and hypertension without the normally observed diuresis and natriuresis in vivo. Studies to date generally confirm the hypothesis that XL-Hgb interferes with NO function in isolated tissues and whole animals. Additionally, other poorly understood physiologic mechanisms may also contribute to the hypertension. DTIC

N95-26763 Air Force Occupational Measurement Center, Randolph AFB, TX.
AEROSPACE MEDICINE Occupational Survey Report
TODD W. KUSTRA, HAROLD HUGULEY, III, and BECKY HERNANDEZ Nov. 1994 69 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(AD-A289691; AFPT-90-901-961) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

This report summarizes the occupational survey results of the Aerospace Medicine Physician utilization field (935X) and the Aerospace Medicine career field (901X0). USAFSAM/ED requested the survey to analyze the effectiveness of the current training program for Aerospace Medicine utilization field (AFSC 93 5X). The analysis incorporates an assessment of the tasks trained in the Aerospace Medicine Primary course and the Aeromedical Specialist course; there is an evaluation of tasks listed in the Course Training Standard (CTS), Specialty Training Standard (STS), and the Career Development Course (CDC); and a comparison of tasks required versus actual tasks performed by incumbents. In addition, several other issues will be analyzed, such as the emergency skills needed for Squadron Medical Element personnel versus those needed for non-Squadron Medical Element personnel, the amount of time spent on patient care versus time spent performing administrative duties, and the scope of job satisfaction for both officers and enlisted personnel. DTIC

N95-26779 Chicago Univ., Chicago, IL. Dept. of Medicine.
BASIC MECHANISMS AND IMPLICATIONS OF NON-PHOTIC ENTRAINMENT OF CIRCADIAN RHYTHMICITY Annual Report, 1 Sep. 1993 - 31 Aug. 1994
EVE VANCAUTER 31 Aug. 1994 7 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract(s)/Grant(s): F49620-92-J-0347)
(AD-A288433; AFOSR-94-0752TR) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

The overall objectives of AFOSR-sponsored studies in Dr Van Cauter's laboratory are to delineate the synchronizing effects of physical exercise and exposure to darkness on the human circadian system and to test the hypothesis that additive effects of adequately timed exposure to pulses of bright light, darkness and exercise may result in large, immediate phase-shifts of human rhythms. Mr. Buxton performed a series of studies related to the first specific aim of the project, namely, to define the role of exercise intensity and duration in causing phase-shifts. The major rationale for examining the role of exercise intensity and duration in causing phase-shifts is to determine whether exercise sessions that can more readily be achieved in real life conditions than a 3-hour period of arm and leg exercise (which was the exercise period used in our previous studies), will have similar zeitgeber potency. Additionally, the use of a shorter duration, higher intensity stimulus would result in more clear-cut neuroendocrine correlates correlates of exercise and may provide important insights regarding the phase-dependence of exercise-induced neuroendocrine activation. DTIC

N95-26885 Naval Medical Research Inst., Bethesda, MD.
A MODEL OF BUBBLE EVOLUTION DURING DECOMPRESSION BASED ON A MONTE CARLO SIMULATION OF INERT GAS DIFFUSION Technical Report, Jun. 1992 - 1993
R. BALL, J. HIMM, L. D. HOMER, and E. D. THALMANN Aug. 1994 139 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract(s)/Grant(s): DA PROJ. MM3-3-P-30)
(AD-A289400; NMRI-94-36) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

Previously, a Monte Carlo simulation of inert gas diffusion in a capillary bed had been developed at this laboratory to explore the effect of tissue heterogeneity and microvascular architecture on gas exchange under normobaric conditions. Because we needed a method of looking at gas phase dynamics during decompression in this environment, the Monte Carlo method was extended to simulate bubble growth and dissolution during decompression. The essence of our approach involves the placement of inert gas particles in a bubble-liquid module and simulating diffusion with random displacements within the module for a short, fixed time period. At the end of the time period the distribution of the particles is used to calculate the number of moles of gas inside the bubble. The new bubble volume is then calculated from the ideal gas law. We developed methods to speed up the simulation by computing distributions of displacements following many random steps so that the simulation of many steps might be made with a simple calculation. In addition, we can calculate the amount of time a particle will stay inside the bubble based on the solubility of the inert gas. We demonstrate that a bubble evolves to the expected equilibrium size and the time course of the evolution compares favorably with that predicted by a partial differential equation model. A Monte Carlo approach is successful in simulating bubble evolution during decompression and is potentially suitable for studying the influence of tissue micro-architecture on gas phase dynamics. DTIC

N95-26889*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
NON-INVASIVE METHOD AND APPARATUS FOR MONITORING INTRACRANIAL PRESSURE AND PRESSURE VOLUME INDEX IN HUMANS Patent Application
JOHN H. CANTRELL, inventor (to NASA) and WILLIAM T. YOST, inventor (to NASA) 24 Aug. 1994 30 p

(NASA-CASE-LAR-13894-1; NAS 1.71:LAR-13894-1; US-PATENT-APPL-SN-297474) Avail: CASI HC A03/MF A01

Non-invasive measuring devices responsive to changes in a patient's intracranial pressure (ICP) can be accurately calibrated for monitoring purposes by providing known changes in ICP by non-invasive methods, such as placing the patient on a tilting bed and calculating a change in ICP from the tilt angle and the length of the patient's cerebrospinal column, or by placing a pressurized skull cap on the patient and measuring the inflation pressure. Absolute values for the patient's pressure-volume index (PVI) and the steady state ICP can then be determined by inducing two known changes in the volume of cerebrospinal fluid while recording the corresponding changes in ICP by means of the calibrated measuring device. The two pairs of data for pressure change and volume change are entered into an equation developed from an equation describing the relationship between ICP and cerebrospinal fluid volume. PVI and steady state ICP are then determined by solving the equation. Methods for inducing known changes in cerebrospinal fluid volume are described. NASA

N95-26917 Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Engineering.

IMAGE PERCEPTION WAVELET SIMULATION AND ENHANCEMENT FOR THE VISUALLY IMPAIRED M.S. Thesis

LEMUEL R. MYERS, JR. Dec. 1994 96 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality

(AD-A289303; AFIT/GEO/ENG/94D-03) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

This research delves into the area of image enhancement for the visually impaired. Binocular macular degeneration a visual impairment, affects many Americans; since this condition could not be corrected with conventional glasses the literature suggested using an enhancement system which used a pre-emphasis algorithm to enhance the input image for output to the observer. The work of Dr. Eli Peli, a pioneer in the field of image enhancement, is examined and reproduced. Since his work concentrated mainly on frequency analysis of images, the bulk of this research involves using discrete wavelet analysis to augment that work. A biorthogonal wavelet set is used to enhance images. That same wavelet set is used to provide a simulation of a person's perception of an image based upon that person contrast sensitivity function. The wavelet enhancement follows Dr. Peli's method of enhancement using a modified pre-emphasis filter. The wavelet enhancement results are similar to that technique, with the most notable difference being that wavelet enhancements tend to accentuate the horizontal and vertical details of the image more than the spatial frequency concentric filter techniques outlined by Peli and others. The perception simulations use wavelet analysis and are based on the work accomplished by Peli concerning 'local band-limited contrast,' with the frequency analysis of that work giving way to a wavelet analysis; the results here are significantly different than those result seen in the Peli simulation. DTIC

N95-26991 Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Engineering.

EXPERIMENTAL DEFINITION FOR IMPLANTATION OF THE AFIT CORTICAL MULTIELECTRODE ARRAY M.S. Thesis

ADAM G. SPENIK Dec. 1994 94 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality

(AD-A289216; AFIT/GE/ENG/94D-27) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

A two-dimensional multiplexed array of 256 electrodes (16 x 16) has been fabricated using conventional CMOS fabrication techniques. The size and spacing of the electrodes (160 x 160 micrometer squares with center-to-center spacing of 250 micrometer) approximate that of the cortical columns. The device is mounted on a small biocompatible package and a protocol to implant this package on the visual cortex of a ferret and a Rhesus monkey was developed and approved. An instrumentation setup to record the data from the device is described as well as the methods used to demultiplex the data. Testing of the device in a simulated cortical environment indicates that the device is capable of recording signals with amplitudes as low as 20 micro volts. This capability is significant as the level of the cortical signal ranges from 20-500 micro volts. An experiment is envisioned in which the primary and secondary visual areas of a mammal are monitored simultaneously in an attempt to gather data while the brain is actually performing perception. This type of study will provide insight to the nature of the organization of the cortico-cortical connectivity matrix and its relation to the function of the cortical column system. DTIC

N95-27039 Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Engineering.

CHARACTERIZATION AND REDESIGN OF THE AFIT MULTIELECTRODE ARRAY M.S. Thesis

RICHARD G. DARENBERG Dec. 1994 120 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality

(AD-A289295; AFIT/GE/ENG/94D-03) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

Since 1978, faculty and graduate students from the Air Force Institute of Technology (AFIT) have been working on an implantable circuit array that can record visual signals from the brain or stimulate the brain. In the current design the circuit is a 16 x 16 array of pads, each pad being 160 x 160 micrometers with 250 micrometers spacing with an 'L' shaped reference pad used as a ground reference. The array is multiplexed so that only one I/O line is required to access all 256 pads. This research was twofold: first to analyze the existing circuit and identify sources for noise and then to redesign the circuit with the intent of reducing noise and power consumption. As a result of the research, a new 16 x 17 array has been developed. The new design incorporates new demultiplexing and synchronizing circuitry. The new circuitry exhibits lower noise and consumes much less power. The 'L' shaped reference pad has been removed-instead each pad and the pad to its right are sampled concurrent1y-one as the sample and one as a reference. DTIC

N95-27059 Department of the Air Force, Brooks AFB, TX. Armstrong Lab.

TO DEVELOP AN AEROSOLING IMMUNOMAGNETIC DEVICE FOR RAPID MEDICAL DIAGNOSIS FROM CLINICAL SAMPLES Midterm Report, 26 Jul. 1993 - 30 Sep. 1994

JOHN G. BRUNO, JOHN P. KILIAN, ARNOTT S. MOORE, JOHNATHAN L. KIEL, and ROBERT REYES 15 Oct. 1994 15 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality

(AD-A288504) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

A system for immunomagnetic capture, fluorescent staining, purification and diagnosis of at least bacterial (if not viral) septicemias is described. The system consists of a semi-automated computer-controlled immunomagnetic column collector and washing device as well as a semi-automated fluorescence microscope which will assist physicians in rapid diagnosis. This system will be used to investigate the efficiency of capture of nonpathogenic (Sterne) Anthrax vegetative cells and spores and possibly other agents of septicemia and body fluid infection. DTIC

N95-27426# Los Alamos National Lab., NM.

MATRIX KERNELS FOR MEG AND EEG SOURCE LOCALIZATION AND IMAGING

J. C. MOSHER, P. S. LEWIS, and R. M. LEAHY (University of Southern California, Los Angeles, CA.) 1994 4 p Presented at the IEEE Conference on Acoustics, Speech and Signal Processing, Detroit, MI, 8-12 May 1995

(Contract(s)/Grant(s): W-7405-ENG-36)

(DE95-005238; LA-UR-94-4387; CONF-9505158-2) Avail: CASI HC A01/MF A01

The most widely used model for electroencephalography (EEG) and magnetoencephalography (MEG) assumes a quasi-static ap-

proximation of Maxwell's equations and a piecewise homogeneous conductor model. Both models contain an incremental field element that linearly relates an incremental source element (current dipole) to the field or voltage at a distant point. The explicit form of the field element is dependent on the head modeling assumptions and sensor configuration. Proper characterization of this incremental element is crucial to the inverse problem. The field element can be partitioned into the product of a vector dependent on sensor characteristics and a matrix kernel dependent only on head modeling assumptions. We present here the matrix kernels for the general boundary element model (BEM) and for MEG spherical models. We show how these kernels are easily interchanged in a linear algebraic framework that includes sensor specifics such as orientation and gradiometer configuration. We then describe how this kernel is easily applied to 'gain' or 'transfer' matrices used in multiple dipole and source imaging models. DOE

N95-27502* National Aeronautics and Space Administration, Washington, DC.

AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 402)

Jun. 1995 103 p

(NASA-SP-7011(402); NAS 1.21:7011(402)) Avail: CASI HC A06

This bibliography lists 244 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during Nov. 1992. Subject coverage includes: aerospace medicine and physiology, life support systems and man/system technology, protective clothing, exobiology and extraterrestrial life, planetary biology, and flight crew behavior and performance. Author

N95-28136# Senes Oak Ridge, Inc., Oak Ridge, TN.

AN INTRODUCTORY GUIDE TO UNCERTAINTY ANALYSIS IN ENVIRONMENTAL AND HEALTH RISK ASSESSMENT. ENVIRONMENTAL RESTORATION PROGRAM

J. S. HAMMONDS, F. O. HOFFMAN, and S. M. BARTELL Dec. 1994 39 p

(Contract(s)/Grant(s): DE-AC05-84OR-21400)

(DE95-008097; ES/ER/TM-35/R1) Avail: CASI HC A03/MF A01

This report presents guidelines for evaluating uncertainty in mathematical equations and computer models applied to assess human health and environmental risk. Uncertainty analyses involve the propagation of uncertainty in model parameters and model structure to obtain confidence statements for the estimate of risk and identify the model components of dominant importance. Uncertainty analyses are required when there is no a priori knowledge about uncertainty in the risk estimate and when there is a chance that the failure to assess uncertainty may affect the selection of wrong options for risk reduction. Uncertainty analyses are effective when they are conducted in an iterative mode. When the uncertainty in the risk estimate is intolerable for decision-making, additional data are acquired for the dominant model components that contribute most to uncertainty. This process is repeated until the level of residual uncertainty can be tolerated. A analytical and numerical methods for error propagation are presented along with methods for identifying the most important contributors to uncertainty. Monte Carlo simulation with either Simple Random Sampling (SRS) or Latin Hypercube Sampling (LHS) is proposed as the most robust method for propagating uncertainty through either simple or complex models. A distinction is made between simulating a stochastically varying assessment endpoint (i.e., the distribution of individual risks in an exposed population) and quantifying uncertainty due to lack of knowledge about a fixed but unknown quantity (e.g., a specific individual, the maximally exposed individual, or the mean, median, or 95%-tile of the distribution of exposed individuals). Emphasis is placed on the need for subjective judgement to quantify uncertainty when relevant data are absent or incomplete. DOE

N95-28318 Aerospace Medical Research Labs., Wright-Patterson AFB, OH. Toxicology Div.

ACUTE AND SUBACUTE TOXICITY OF AMMONIUM DINITRAMIDE (ADN)

D. R. TOCCO, S. A. SALINS (ManTech Environmental Technology, Inc., Wright-Patterson AFB, OH.), R. E. WOLFE (ManTech Environmental Technology, Inc., Wright-Patterson AFB, OH.), and E. R. KINKEAD (ManTech Environmental Technology, Inc., Wright-Patterson AFB, OH.) *In* Johns Hopkins Univ., The 1994 JANNAF Safety and Environmental Protection Subcommittee Meeting, Volume 1 p 331-334 Aug. 1994

(Contract(s)/Grant(s): F33615-90-C-0532)

Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Ammonium Dinitramide (ADN) is currently being considered to replace ammonium perchlorate by the Department of Defense. The chemical will be used in solid rocket engine propellant mixtures as well as a high explosive. No acute or chronic toxicity data is currently available for ADN, however field reports from exposed personnel indicate that the chemical is readily absorbed by the skin, resulting in numbness of the fingers. Because the most significant exposure route expected for ADN would be dermal exposure or possibly accidental ingestion, acute oral and dermal toxicity tests were conducted. In preparation for a reproductive screen on ADN, stability and palatability studies were also conducted. Oral administration of ADN at 5g/kg body weight (EPA limit dose) produced convulsions and rapid death in all treated rats. Subsequent studies indicated an acute LD(sub 50) in F-344 rats of 823 mg/kg. Dermal application of 2g/kg (EPA limit dose) produced no toxic signs in rabbits. Administration of either 12, 25, 50, or 100 mg ADN/ml drinking water on a continuous basis for 2 weeks to male and females SD rats produced no apparent effect on body weight gains, water consumption, organ weights, hemoglobin concentration, or methemoglobin formation. A reproductive toxicity screen of ADN in drinking water is currently in progress. Author

N95-28319 Walter Reed Army Inst. of Research, Wright-Patterson AFB, OH.

TOXICITY ASSESSMENT OF LIQUID PROPELLANT XM46

DANIEL J. CALDWELL *In* Johns Hopkins Univ., The 1994 JANNAF Safety and Environmental Protection Subcommittee Meeting, Volume 1 p 335-342 Aug. 1994

Avail: CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC

Liquid propellant XM46 is a developmental propellant that will be used with the regenerative injection gun in the Advanced Field Artillery System. The components of XM46 are both strongly reducing and oxidizing agents, are corrosive, and possess strong nitrating characteristics. XM46 is moderately toxic; the primary systemic effects are the production of methemoglobin, altered liver function, and enlargement of the spleen and liver. XM46 also produces skin irritation, is a strong eye irritant, and causes skin sensitization in guinea pigs but not humans. Aerosolized XM46 produces respiratory irritation. Genotoxicity evaluations of XM46 were negative. Since the Army recently opened to women many previously male-only occupational specialties, women now face potential accidental exposure to XM46 during both operational and maintenance procedures. XM46 was evaluated to determine its potential to produce reproductive toxicity, such as alterations in paternal fertility, maternal pregnancy and lactation, and growth and development of offspring. Sprague-Dawley rats were dosed with 200, 1000, or 2000 mg XM46 per liter of drinking water (target dose of 12, 60, and 120 mg of XM46 per kg body weight per day, i.e., mg/kg/day) for 14 days prior to mating, during gestation, postpartum (21 days), and for four weeks postweaning for a total of 90 days. Pups were maintained on treated water for four weeks postweaning. Although there were dose related effects in parental animals, there were no treatment related adverse reproductive effects (mating, fertility index, length of gestation, sex ratio, gestation index, or mean number of offspring per litter) compared to control (i.e., non-treated) animals. Mean pup weights showed no statistically significant differences between treated and control groups. In a mouse dominant lethal assay, XM46

was shown not to have dominant lethal effects on fertility or reproduction at doses of 100, 200, and 400 mg/kg/day compared to control animals. A teratology study was undertaken to determine if XM46 causes birth defects in the developing fetus. Animals were treated with XM46 at doses of 162.5, 325, and 650 mg/kg/day during the major period of organogenesis to determine if developmental variations and malformations were produced in offspring. The incidence of fetal death (number of dead fetuses plus the number of resorptions) was not significantly different between dose groups. The number of live fetuses per litter was not significantly different between dose groups. No evidence of fetal toxicity related to XM46 exposure was noted in any of the dose groups. Based on these data it is concluded that XM46 is not a reproductive toxicant or teratogen in the rat. Author

N95-28561 Krug Life Sciences, Inc., San Antonio, TX. San Antonio Div.
A STUDY OF HEART RATE AND HEART RATE VARIABILITY DURING RAPID DECOMPRESSION TO 50,000 FT Final Report, 11 May 1989 - 8 Nov. 1992
C. S. CHOPP, JOHN B. BOMAR, JR., and JOHN A. DELLINGER Sep. 1994 27 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract(s)/Grant(s): F33615-89-C-0603)
(AD-A291598; AL/CF-TR-1994-0043) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

A previous study of the heart rate (HR) response to positive pressure breathing (PPB), anxiety and hypoxia during rapid decompression (RD) revealed a consistent pattern in the beat-to-beat or interbeat interval variability of HR, known in the literature as heart rate variability (HRV). One method of analyzing HRV is a noninvasive measure of the respiratory-cardiac neural reflex known as vagal tone monitoring. This method is based on the amplitude of respiratory sinus arrhythmia (RSA) as a manifestation of vagal cardioinhibitory influence on the heart. The RD/HR data were interpreted by two HRV analysis methods, vagal tone monitoring (VTM) and a method developed in-house based on maximum entropy method (MEM) (spectral analysis), as a means of studying the heart rate regulating mechanisms during RD. A significant drop in vagal tone in both HRV measures was shown during the PPB and hypoxia profiles. Conflicting results regarding the anxiety profile during RD leave room for questions as to the use of these HRV measures as a tool for assessing anxiety or emotional stress. However, these measures only examined a subset of the HRV frequency spectrum (the respiratory frequency range) which provides information only on the parasympathetic autonomic contributions. Investigation of other frequency bands may provide more complete data on the autonomic regulation of the cardiovascular system. DTIC

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BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

A95-83868
BEHAVIORISM, COGNITIVISM AND THE NEUROPSYCHOLOGY OF MEMORY
HERBERT L. PETRI Towson State University, Towson, MD, US and MORTIMER MISHKIN American Scientist (ISSN 0003-0996) vol. 82, no. 1 January-February 1994 p. 30-37
(HTN-95-42102) Copyright

earning is a remarkable ability that is shared by all animals. Recent neuropsychological research supports the view that the brain has two systems for learning. Habit-based learning and memory-based (cognitive) learning are examined. This dual system model, which is meant to apply to the major divisions between systems, proposes that the acquistion and retention of the effects of experience are best understood as resulting from the action of two fundamentally different learning and retention systems. These systems use different circuitry within the brain, store different aspects of experience, and follow different rules of storage. Perhaps the debate over which of these two perspectives is correct can now be put aside, allowing both models to be embraced and used. Herner

A95-83869
HOW ARE CONTROL SYSTEMS CONTROLLED?
KNUT SCHMIDT-NIELSEN Duke University, Durham, NC, US American Scientist (ISSN 0003-0996) vol. 82, no. 1 January-February 1994 p. 38-44
(HTN-95-42103) Copyright

Many of the mechanisms that control animal functions are understood, but exactly how these mechanisms are governed is still obscure. Sodium regulation in Isle Royale moose; water regulation; body temperature control in mammals and birds; the use of fever as a defense against disease; and diurnal fluctuations of body temperatures in camels are examined. The question of long term changes in regulation is discussed. Herner

A95-84375
SIMULTANEOUS DISCRIMINATION OF THE SPATIAL FREQUENCY AND CONTRAST OF PERIODIC STIMULI
MARK W. GREENLEE Univ of Freiburg, Freiburg, Germany and JAMES P. THOMAS Journal of the Optical Society of America A: Optics and Image Science (ISSN 0740-3232) vol. 10, no. 3 March 1993 p. 395-404 refs
(BTN-94-EIX95012419657) Copyright

Psychophysical experiments are reported to study effects of stimulus uncertainty on discrimination thresholds with discriminated gratings differing along either one of stimulus dimensions. Single and dual judgement tasks were performed. Spatial frequency and contrast thresholds were directly proportional to stimulus bandwidth and inversely proportional to stimulus contrast. EI

A95-85333
PREDICTING AIRCRAFT PILOT-TRAINING SUCCESS: A META-ANALYSIS OF PUBLISHED RESEARCH
DAVID R. HUNTER Federal Aviation Administration, Washington, DC, US and EUGENE F. BURKE London Fire and Civil Defence Authority, UK International Journal of Aviation Psychology (ISSN 1050-8414) vol. 4, no. 4 Spring p. 297-313
(HTN-95-92289) Copyright

Results are given from a meta-analysis of validities for aircraft pilot-selection measures. Sixty-eight published studies were identified for the 1940-to-1990 period, from which 468 correlations were extracted for a cumulated sample of 437,258 cases. The method proposed by Hunter and Schmidt (1990b) was applied to produce a bare-bones analysis. Mean sample-weighted correlations, estimates of true variance, and confidence intervals were computed. Several classes of predictors were found to have confidence intervals that did not include zero, indicating possible generalizability of validities. For the most part, however, the variance accounted for by sampling error alone was small. The effects of moderator variables (including nationality, service, decade of publication, and aircraft type) were evaluated. Of these, decade of publication was most consistently correlated with obtained validities and was associated with a decline in average validities over the five decades of studies examined. Limitations on interpretation of the results and problems associated with the analysis and interpretation of data from the published reports are discussed, and the range of correlations that might be expected from a composite of the groups of predictors that were examined is reported. Author (Herner)

A95-85337
EYE ACCOMMODATION: USE OF VERNIER OPTOMETERS IN BEHAVIORAL RESEARCH
STANLEY N. ROSCOE ILLIANA Aviation Sciences Limited, Arcata, CA, US, LOUIS CORL ILLIANA Aviation Sciences Limited, Las Cruces, NM, US, and DONALD H. COUCHMAN ILLIANA Aviation

Sciences Limited, Las Cruces, NM, US International Journal of Aviation Psychology (ISSN 1050-8414) vol. 4, no. 4 Spring p. 359-371
(HTN-95-92293) Copyright

The history of the invention and development of devices suitable for the measurement of eye accommodation in behavioral research settings is briefly reviewed. A series of small experiments involving a Micro Vernier Optometer (TM) that is 'worn' on the head demonstrated the practicality of using the device in a variety of dynamic, real-world situations including flying an airplane simulator, driving an automobile, and — with certain constraints — typing at a video display terminal. Some surprising incidental findings are relevant to virtual imaging displays and to the Mandelbaum effect. Author (Herner)

A95-85880
EFFECTS OF GRAPHIC AND VERBAL PROBABILITY INFORMATION ON COMMAND DECISION MAKING
SUSAN S. KIRSCHENBAUM Naval Undersea Warfare Center Division, Newport, Rhode Island, US and JAMES E. ARRUDA University of Rhode Island, Kingston, Rhode Island, US Human Factors (ISSN 0018-7208) vol. 36, no. 3 September 1994 p. 406-418
(HTN-95-B0064) Copyright

The performance effects of graphic and verbal representations of uncertainty were investigated within the context of a spatial problem. Sixteen experienced naval submarine officers acted as decision makers (i.e., submarine commanders) in eight simulated scenarios. Four scenario problems were presented with either a verbal or a graphic representation of uncertainty. The degree of uncertainty was controlled by manipulating oceanic conditions and information modeling. The graphic representation of uncertainty resulted in superior range estimates only when the oceanic noise was high and the environmental information was properly modeled. No reliable differences in confidence were observed. These results suggest that for spatial problems, a graphic/spatial representation of uncertainty may considerably improve the judgement of decision makers. Author (Herner)

A95-85881* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
A COMPONENTIAL MODEL OF HUMAN INTERACTION WITH GRAPHS: 1. LINEAR REGRESSION MODELING
DOUGLAS J. GILLAN University of Idaho, Moscow, Idaho, US and ROBERT LEWIS Pacific Northwest Laboratory, Richland, Washington, US Human Factors (ISSN 0018-7208) vol. 36, no. 3 September 1994 p. 419-440
(Contract(s)/Grant(s): NAS9-17900)
(HTN-95-B0065) Copyright

Task analyses served as the basis for developing the Mixed Arithmetic-Perceptual (MA-P) model, which proposes (1) that people interacting with common graphs to answer common questions apply a set of component processes-searching for indicators, encoding the value of indicators, performing arithmetic operations on the values, making spatial comparisons among indicators, and repsonding; and (2) that the type of graph and user's task determine the combination and order of the components applied (i.e., the processing steps). Two experiments investigated the prediction that response time will be linearly related to the number of processing steps according to the MA-P model. Subjects used line graphs, scatter plots, and stacked bar graphs to answer comparison questions and questions requiring arithmetic calculations. A one-parameter version of the model (with equal weights for all components) and a two-parameter version (with different weights for arithmetic and nonarithmetic processes) accounted for 76%-85% of individual subjects' variance in response time and 61%-68% of the variance taken across all subjects. The discussion addresses possible modifications in the MA-P model, alternative models, and design implications from the MA-P model. Author (Herner)

A95-85882
PSYCHOPHYSICAL FOUNDATIONS OF A MODEL OF AMPLIFIED NIGHT VISION IN TARGET DETECTION TASKS
WILLIAM R. UTTAL Arizona State University, Temple, Arizona, US, TODD BARUCH Arizona State University, Temple, Arizona, US, and LINDA ALLEN Arizona State University, Temple, Arizona, US Human Factors (ISSN 0018-7208) vol. 36, no. 3 September 1994 p. 488-502
(Contract(s)/Grant(s): F49620-92-J-0176)
(HTN-95-B0066) Copyright

In this article we examine some of the basic psychophysics relevant to amplified night vision devices. These devices produce images that are substantially different from ordinary visual scenes. Distortions in contrast and luminance and the introduction of visual interference and geometrical artifacts contribute to unusual viewing conditions. We carried out experiments to determine the effect of these parameters of the image on a highly controlled visual target detection task simulated on a computer graphics system that closely models a night vision device. Our results indicate that display luminance and geometrical artifacts degrade detection performance only slightly, whereas contrast and visual interference have a substantial degrading effect. Author (Herner)

A95-85883
THE ROLES OF IMMEDIACY AND REDUNDANCY IN RELATIVE SUBJECTIVE WORKLOAD ASSESSMENT
PAMELA S. TSANG Wright State University, Dayton, Ohio, US and MICHAEL A. VIDULICH Wright-Patterson Air Force Base, Ohio, US Human Factors (ISSN 0018-7208) vol. 36, no. 3 September 1994 p. 503-513
(HTN-95-B0067) Copyright

Subjective workload assessment is one of the most frequently used tools for system evaluation. However, little is known about which factors contribute to the sensitivity, validity, and reliability of subjective workload ratings. One major classification of subjective workload assessment tools is based on relative judgments of the workload of different task conditions. The present research evaluated different approaches to relative subjective workload assessment in terms of their sensitivity to demand manipulations, concurrent validity with performance, and test-retest reliability. Results indicated that performing relative judgments retrospectively after having experienced all task conditions was superior to rating each task condition immediately after performing it. Further, redundant relative comparisons may produce more sensitive ratings than do relative comparisons to a single reference task. Overall, the results support the use of retrospective relative workload judgments as an evaluation tool. Author (Herner)

A95-85884
PSYCHOPHYSIOLOGICAL MEASURES OF WORKLOAD DURING CONTINUOUS MANUAL PERFORMANCE
RICHARD W. BACKS Wright State University, Dayton, Ohio, US, ARTHUR M. RYAN Wright State University, Dayton, Ohio, US, and GLENN F. WILSON Wright-Patterson Air Force Base, Ohio, US Human Factors (ISSN 0018-7208) vol. 36, no. 3 September 1994 p. 514-531
(Contract(s)/Grant(s): F49620-88-C-0053)
(HTN-95-B0068) Copyright

Twelve subjects (six female) participated in an experiment designed to separate the effects of perceptual/central and physical demands on psychophysiological measures of peripheral nervous system activity. The difficulty of a single axis continuous manual tracking task was varied in two ways: order of control was manipulated to vary perceptual/central processing demand, and disturbance amplitude was manipulated to vary physical demand. Physiological measures were sensitive to the imposition of a task and were more sensitive to physical than to perceptual/central demands. A principal components analysis identified five factors (three of them physiological) that accounted for 83.1% of the observed variance. Perceptual/central processing demands specifically affected the component identified with sympathetic cardiovascular control, whereas physical demands were reflected in the component identified with parasympathetic cardiovascular control.

This finding suggests that dissociations observed among cardiovascular measures in manual performance tasks are attributable to differential activation of the autonomic control systems.
Author (Herner)

A95-85885
INFLUENCE OF WARNING LABEL SIGNAL WORDS ON PERCEIVED HAZARD LEVEL
MICHAEL S. WOGALTER North Carolina State University, Raleigh, North Carolina, US, STEPHEN W. JARRARD U.S. Military Academy, West Point, New York, US, and S. NOEL SIMPSON Rensselaer Polytechnic Institute, Troy, New York, US Human Factors (ISSN 0018-7208) vol. 36, no. 3 September 1994 p. 547-556
(HTN-95-B0069) Copyright

This experiment investigated the influence of warnings, signal words, and a signal icon on perceived hazard of consumer products. Under the guise of a marketing research study, 135 people (high school students, college students, and participants from a shopping mall) rated product labels on six dimensions, including how hazardous they perceived the products to be. A total of 16 labels from actual household products were used: 9 carried the experimental conditions, and 7 were filler product labels that never carried a warning. Five conditions presented the signal words NOTE, CAUTION, WARNING, DANGER, and LETHAL together with a brief warning message. In another two conditions, a signal icon (exclamation point surrounded by a triangle) was presented together with the terms DANGER and LETHAL. In the final two conditions, one lacked a signal word but retained the warning message, and the other lacked both the warning message and the signal word. Results showed that the presence of a signal word increased perceived product hazard compared with its absence. Significant differences were noted between extreme terms (e.g., NOTE and DANGER) but not between terms usually recommended in warning design guidelines (e.g., CAUTION and WARNING). The signal icon showed no significant effect on hazard perception. Implications of the results and the value of the methodology for future warnings investigations are discussed. Author (Herner)

A95-85988
MOTOR ACTIVITY AND DEPRESSION-RELATED DISORDERS
BARRY L. JACOBS Princeton Univ., Princeton, NJ, US American Scientist (ISSN 0003-0996) vol. 82, no. 5 September-October 1994 p. 456-463
(HTN-95-11907) Copyright

Clues to the origin and treatment of depression and obsessive-compulsive disorders can be found in the role of serotonin neurons in the brain. Comtemporary views hold that low levels of the neurotransmitter serotonin may account for many of the symptoms associated with depressive illness. The author proposes that serotonin may also be the link between low levels of motor activity and depressed moods. Author (Herner)

A95-86643* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
UNDERSTANDING THE DETERMINANTS OF PROBLEM-SOLVING BEHAVIOR IN A COMPLEX ENVIRONMENT
STEPHEN A. CASNER NASA Ames Research Center, Moffett Field, CA, US Human Factors (ISSN 0018-7208) vol. 36, no. 4 December 1994 p. 580-596
(HTN-95-20753) Copyright

It is often argued that problem-solving behavior in a complex environment is determined as much by the features of the environment as by the goals of the problem solver. This article explores a technique to determine the extent to which measured features of a complex environment influence problem-solving behavior observed within that environment. In this study, the technique is used to determine how complex flight deck and air traffic control environment influences the strategies used by airline pilots when controlling the flight path of a modern jetliner. Data collected aboard 16 commercial flights are used to measure selected features of the task environment. A record of the pilots' problem-solving behavior is analyzed to determine to what extent behavior is adapted to the environmental features that were measured. The results suggest that the measured features of the environment account for as much as half of the variability in the pilots' problem-solving behavior and provide estimates on the probable effects of each environmental feature. Author (Herner)

A95-86644
INFLUENCE OF EXTENDED WAKEFULNESS ON AUTOMATIC AND NONAUTOMATIC PROCESSING
DARRYL G. HUMPHREY University of Illinois, Urbana, IL, US, ARTHUR F. KRAMER University of Illinois, Urbana, IL, US, and ROBERT R. STANNY Pensacola Naval Aerospace Medical Research Laboratory, Pensacola, FL, US Human Factors (ISSN 0018-7208) vol. 36, no. 4 December 1994 p. 652-669
(HTN-95-20754) Copyright

We investigated the influence of extended wakefulness on automatic and nonautomatic processes in memory and visual search tasks. Subjects were trained in consistently mapped and variably mapped versions of each task, attaining automatic performance in the consistently mapped versions. We then recorded performance measures and event-related brain potentials for a 14-h period that began during the evening of the last day of training. Overall performance declined with extended wakefulness, but the benefits of consistently mapped training were retained throughout the night. Performance decrements consisted of an increase in nonresponses, increased response latencies, and decreased accuracies. P300 latencies increased, and P300 amplitudes decreased with extended wakefulness. When viewed together, reaction time and event related brain potentials measures suggest that the locus of extended wakefulness effects was during early perceptual processes. Author (Herner)

A95-86645
P300 AS A MEASURE OF WORKLOAD DURING A SIMULATED AIRCRAFT LANDING TASK
BARRY FOWLER York University, Downsview, Ontario, Canada Human Factors (ISSN 0018-7208) vol. 36, no. 4 December 1994 p. 670-683
(Contract(s)/Grant(s): W7711-6-9019; W7711-7-7011)
(HTN-95-20755) Copyright

The P300 component of the event-related brain potential was assessed as a measue of mental workload using 12 subjects who flew simulated visual flight rules final approaches and landings under workloads varied by manipulating turbulence and hypoxia. P300 was elicited with auditory and visual oddball subsidiary tasks requiring the detection of infrequent tone or flashes of an artificial horizon. The results showed that root mean square error flying performance was systematically degraded by both workload manipulations. P300 amplitude exhibited a complex pattern that was not strongly related to performance. By cotrast, P300 latency covaried closely with performance, increasing as a function of workload in both modalities. These ressults suggest that P300 latency indexes the slowing of perceptual/cognitive processing caused by workload and that this measure is sensitive to an important aspect of flying. Author (Herner)

A95-86646
TACTILE STIMULATION OF THE HUMAN HEAD FOR INFORMATION DISPLAY
KIRBY GILLILAND University of Oklahoma, Norman, OK, US and ROBERT E. SCHLEGEL University of Oklahoma, Norman, OK, US Human Factors (ISSN 0018-7208) vol. 36, no. 4 December 1994 p. 700-717
(Contract(s)/Grant(s): AB0211)
(HTN-95-20756) Copyright

A series of three studies was conducted to explore the use of tactile stimulation or light tapping of the human head to inform a pilot of possible threats or other situations in the environmet. Study 1 confirmed that subjects could achieve 100% detection of the tactile stimulation. Localized performance, measured in Study 2 depended on the number of different stimulus sites and ranged from 93% accuracy for 6 sites to 47% accuracy for 12 sites across the parietal

meridian of the head. In Study 3 we investigated the effect of performing the localization task simultaneously with a dual memory/ tracking task or an air combat simulation task. These studies demonstrated that tactile information display could be an integral contributor to improved situatioal awarness, but not without cost to other task performance. The results of Study 3 were also examined with reference to popular models of attention and workload.
Author (Herner)

N95-26361# Civil Aeromedical Inst., Oklahoma City, OK.
ENHANCING THE EFFECTS OF DIVERSITY AWARENESS TRAINING: A REVIEW OF THE RESEARCH LITERATURE Final Report
JENNIFER G. MEYERS Mar. 1995 28 p
(DOT/FAA/AM-95/10) Avail: CASI HC A03/MF A01

The projected changes in the demographic makeup of the workforce were primary influences in the spread of diversity awareness training in the private and public sector. One approach to training aims at changing personal attitudes and values to effect positive changes in treatment of others different from oneself (especially protected groups) in the workplace. The effectiveness of training or other interventions that focus on changes in attitudes to change behavior has not been clearly demonstrated. Training interventions need to use a combination of methods or strategies before, during, and after training to enhance the measurable benefits received from diversity awareness training and avoid the potential for 'white male backlash' and psychological risk among participants. Implementation of a training evaluation plan and a research program for identifying characteristics of effective training are also necessary to enhance training effectiveness in the longer term. Author

N95-26683 Air Force Inst. of Tech., Wright-Patterson AFB, OH.
ANALYSIS OF GROUP PERFORMANCE IN VISUAL SIGNAL DETECTION M.S. Thesis
CHRISTOPHER J. HAYS Jan. 1995 119 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(AD-A289561; AFIT/CI/CIA/94-145) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

This study analyzed how a group's decision making performance compared to the predicted performance of a statistically 'optimal' group on a visual signal detection task. The task was to decide, either individually or as a group, whether a stimulus display screen (composed of nine independent information sources) was representative of one of two possible normal distributions (signal or noise). Eight subjects were tested individually and as members of different sized groups. Sorkin and Dai's 1994 model of the Ideal Group was used to analyze the accuracy of group performance (d'(sub grp)). Consistent with the model of the Ideal Group, d'(sub grp) increased with the number of group members, but decreased with intermember correlation and task difficulty. The group decision process was assumed to be based on the group assigning different weights (emphasis) to each group members' input. Overall efficiency, a relative measure of actual performance compared to ideal performance, was relatively high for two-member groups but decreased as the group grew larger. Group weighting strategies appeared to be somewhat variable for the condition in which all sources of information presented to the members were equally valid. However, when the sources of information were unequal, the group appropriately assigned more weight to the group members with the more reliable information. Some interesting social interaction phenomena were theorized to take place during the group decision process. Social loafing, coordination loss, and outgoingness were examined as possible reasons for changes in group performance. Interestingly, the subjects received more weight when they acted as the spokesperson for the group compared to when they did not respond for the group. DTIC

N95-26691 Wright State Univ., Dayton, OH.
CODES OF PROCESSING AND MULTIPLE RESOURCES: MODEL AND METHODOLOGY
MICHAEL A. STADLER 1994 40 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(AD-A289583) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

The current multiple resources methodology was employed to test the spatial-verbal distinction in the Wickens multiple resources model. Twelve subjects participated in a timesharing experiment in which a verbal memory search task was paired with another verbal and a spatial task. Reaction time and error data were examined and revealed that the verbal-verbal combination was generally performed at greater cost and with more interference than the spatial-verbal one. The results were interpreted as general support for the multiple resources distinction between the two codes of processing. DTIC

N95-26692 Aerospace Medical Research Labs., Wright-Patterson AFB, OH.
HANDBOOK OF PERCEPTION AND HUMAN PERFORMANCE, VOLUME 2. COGNITIVE PROCESSES AND PERFORMANCE
KENNETH R. BOFF, LLOYD KAUFMAN, and JAMES P. THOMAS 1994 49 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(AD-A289587) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

This chapter has attempted to bring together the laboratory and field-based techniques currently in use to assess workload. No doubt, many specific procedures of interest to particular applications have been left out of this survey. In no sense is this meant to summarily exclude these from any list of valid workload assessment techniques. In fact, several of these are acknowledged to show considerable promise (e.g., occlusion techniques and respiratory rhythms). They are not discussed here partly because of space limitations and partly because a judgment had to be made concerning the practicality and general applicability of each measure. It is hoped that the inclusion of general references will serve to point the interested reader to the individual techniques not included here. Similarly, a class of techniques frequently used to assess workload was deliberately excluded from this chapter. Task analytic methods, particularly as they are used with computer models of whole missions or operations, constitute an important tool for workload investigations during design and other stages of aircraft and systems development. These techniques, however, are primarily off-line analyses that utilize the kind of laboratory and field data gathered with the techniques such as those described in this chapter. They provide an overall systems answer to the workload question and as such deserve separate treatment from highly specific workload measures. DTIC

N95-26825 Wright State Univ., Dayton, OH.
SUBJECTIVE WORKLOAD ASSESSMENT IN A SPATIAL MEMORY TASK
F. T. EGGEMEIER and MICHAEL A. STADLER Oct. 1994 5 p Prepared in cooperation with Systems Research Lab. Inc. Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(AD-A289491) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

Twelve subjects performed a spatial short-term memory task under several levels of difficulty and rated the workload associated with each using the Subjective Workload Assessment Technique (SWAT). SWAT ratings proved sensitive to two of the three difficulty manipulations in the memory task, and demonstrated greater sensitivity in this respect than either of two primary task measures that were employed. The results extend the applicability of SWAT to the type of spatial memory task used and, therefore, provide further support for the general applicability of SWAT as a workload measurement technique. DTIC

N95-26843 Maryland Univ., College Park, MD.
LEARNING HAND/EYE COORDINATION BY AN ACTIVE OBSERVER. PART 1: ORGANIZING CENTERS Technical Report

JEAN-YVES HERVE Jul. 1994 74 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract(s)/Grant(s): DACA76-92-C-0009; N00014-93-1-0257)
(AD-A289502; CAR-TR-725; CS-TR-3319) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

This report, the first of a three-part series, presents preliminary results in a study on the role of the active observer in the hand/eye coordination problem. It was shown elsewhere that the hand/eye coordination problem can be represented, for a given pose of the observer, by the singularities of a surface, the perceptual control surface (PCS). Small changes in the pose of the observer generally produce smooth deformations of the PCS. There are configurations, however, from which arbitrarily small modifications of the point of view result in profound changes in the topological nature of the PCS. This paper studies these bifurcation configurations and, furthermore, investigates the possibility of determining a priori displacements of the observer that can achieve a desired effect on the PCS such as simplifying its topology or reducing the number of singularities separating the current configuration from a goal to be reached. The result of this analysis takes the form of the 'family portrait' of all possible aspects of the PCS, indexed by the geometry of the manipulator and the pose of the observer relative to it. A hand/eye system is then completely coordinated - has 'learned its PCS' - when a 'portrait' has been matched with the experimental data gathered by the low-level controller. DTIC

N95-26909 Helsinki Univ. of Technology, Espoo (Finland). Lab. of Industrial Psychology.
CHANGE, LEARNING AND MENTAL WORK IN ORGANIZATIONS: WORKING PAPERS OF THE 3RD OTANIEMI-DRESDEN WORKSHOP
MATTI VARTIAINEN, ed. and VEIKKO TEIKARI, ed. 1994 142 p Workshop was held in Helsinki, Finland, Dec. 1994 Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(ISSN 0784-3623)
(PB95-184941; ISBN-951-22-2231-0) Avail: CASI HC A07

Contents are as follows: Managing change: Structured Implementation of a Process of Change in an Insurance Company; Job Content and Myocardial Health Risks - Consequences for Occupational Prevention; Analyzing the Implementation of Business Strategy in a Service Organization Critically; What is Organizational Learning; Participative Development and Organizational Learning with Work Flow Game; Mental Work Requirements: Some Issues of Analysis and Evaluation; Research on Leadership and Managerial Behavior - A State of the Art; From Fragmented to Complete Expert Work; The Modeling of Activity Requirements in an Employment Service Agency; and Finnish Experiences in Using TBS-GA. NTIS

N95-26992 Phillips Lab., Hanscom AFB, MA.
DIAGNOSING CLOUDINESS FROM GLOBAL NUMERICAL WEATHER PREDICTION MODEL FORECASTS Final Report, Oct. 1991 - Sep. 1993
DONALD C. NORQUIST, H. S. MUENCH, DONALD L. AIKEN, and DOUGLAS C. HAHN 5 Jul. 1994 150 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract(s)/Grant(s): AF PROJ. 6670)
(AD-A289456; PL-TR-94-2211; ERP-1156) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

We investigated the utility of any information derivable from noncloud numerical weather prediction (NWP) model forecasts in inferring layer cloud amount distributions. This effort involved identifying and preparing a suitable source of the predictand (cloud amount), generating and preparing a suitable source of the predictors (NWP variables and geographic information), and combining them to form diagnostic relationships in a model output statistics approach. Both AFGWC RTNEPH cloud analyses and Phillips Laboratory Global Spectral Model (PL GSM) NWP forecasts were rendered on a 125 km equal-area grid in three cloud deck regimes (high, middle, low). Two statistical methods CLOUD CURVE ALGORITHM (CCA), a univariate method, and multiple linear regression (MLR) were used to relate the cloud amount to relative humidity (CCA) and to relative humidity and a large number of other NWP variables (MLR). The authors found that the CCA method preserves the sharpness of the cloud distribution while sacrificing skill, while MLR produced cloud diagnoses that were more skillful but less sharp. The methods fall short of the error level standards established by Air Force requirements, but show potential for useful cloud forecast skill upon further refinement. DTIC

N95-27012 Aeronautical Systems Div., Wright-Patterson AFB, OH.
VISUAL SYSTEM OPERATIONAL EVALUATION Final Report, 19 Feb. 1993 - 31 Jul. 1994
JAMES E. BROWN, TIMOTHY J. LINCOURT, MELISSA J. LEOS, DON R. POE, and GARY S. ALLARD 31 Jul. 1994 113 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(AD-A289173; ASC-TR-94-5030) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

This evaluation was undertaken to identify the capability and limitations of current visual simulation to support low altitude flight training. Purpose was: (1) determine trainability of low altitude tasks on available visual display technology; (2) demonstrate current visual requirements; and (3) provide information and data to support future simulation acquisition decisions. Three visual simulation display technologies located at three different sites were evaluated: (1) dome display with head tracked area-of-interest, (2) rear-projection display, and (3) helmet mounted display. Highly experienced F-16C and F-15E instructor pilots evaluated each display technology. A standard list of evaluation tasks was used to evaluate each system in a mission context. Extensive questionnaires were completed and debriefings conducted to rate the training capability of the simulator to provide mission readiness (MR) and continuation training (CT) for operational aircrews (both wingman and flight leads). Major conclusions are (1) single ship air-to-ground tasks are trainable now with the right combination of database, image generator, and matched visual display system; and (2) current systems do not provide adequate resolution, contrast, and brightness to allow for dynamic air model assessment. DTIC

N95-27013 Carnegie-Mellon Univ., Pittsburgh, PA. Robotics Inst.
USING VIRTUAL ACTIVE VISION TOOLS TO IMPROVE AUTONOMOUS DRIVING TASKS
TODD M. JOCHEM Oct. 1994 23 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract(s)/Grant(s): DACA76-89-C-0014; DAAE07-90-C-R059)
(AD-A289175; CMU-RI-TR-94-39) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

ALVINN is a simulated neural network for road following. In its most basic form, it is trained to take a subsampled, preprocessed video image as input, and produce a steering wheel position as output. ALVINN has demonstrated robust performance in a wide variety of situations, but is limited due to its lack of geometric models. Grafting geometric reasoning onto a nongeometric base would be difficult and would create a system with diluted capabilities. A much better approach is to leave the basic neural network intact, preserving its real-time performance and generalization capabilities, and to apply geometric transformations to the input image and the output steering vector. These transformations form a new set of tools and techniques called virtual active vision. The thesis for this work is: virtual active vision tools will improve the capabilities of neural network based autonomous driving systems. DTIC

N95-27181 Industrial Coll. of the Armed Forces, Washington, DC.
MYERS-BRIGGS TYPE INDICATORS AND KIRTON ADAPTION-INNOVATION INVENTORY CORRELATIONS Research Report, Aug. 1993 - Apr. 1994
MELANIE A. HUGHES Apr. 1994 38 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(AD-A288435; NDU-ICAF-94-F28) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

This research report focuses upon the results and the raw data of the Myers-Briggs Type Inventory, and the Kirton Adaption Innovation Inventory administered to the Industrial College of the Armed Forces Class of 1994. DTIC

N95-27323# Civil Aeromedical Inst., Oklahoma City, OK.
PRACTICAL COLOR VISION TESTS FOR AIR TRAFFIC CONTROL APPLICANTS: EN ROUTE CENTER AND TERMINAL FACILITIES Final Report
HENRY W. MERTENS, NELDA J. MILBURN, and WILLIAM E. COLLINS Apr. 1995 15 p
(DOT/FAA/AM-95/13) Avail: CASI HC A03/MF A01

Two practical color vision tests were developed and validated for use in screening Air Traffic Control Specialist (ATCS) applicants for work at en route center or terminal facilities. The development of the tests involved careful reproduction/simulation of color-coded materials from the most demanding, safety critical color task performed in each type of facility. The tests were evaluated using 106 subjects with normal color vision and 85 with color vision deficiency. The en route center test, named the Flight Progress Strips Test (FPST), required the identification of critical red/black coding in computer printing and handwriting on flight progress strips. The terminal option test, named the Aviation Lights Test (ALT), simulated red/green/white aircraft lights that must be identified in night ATC tower operations. Color coding is a non-redundant source of safety-critical information in both tasks. The FPST was validated by direct comparison of responses to strip reproductions with responses to the original flight progress strips. Validity was high; Kappa = .91. The light point stimuli of the ALT were validated physically with a spectroradiometer. The test lights met the FAA and ICAO standards for colors of aircraft and aviation signal lights. The reliabilities of the FPST and ALT were estimated with Chronbach's alpha and were .93 and .98, respectively. The high job-relevance, validity, and reliability of these tests increases the effectiveness and fairness of ATCS color vision testing. Author

N95-27697*# Legacy Good Samaritan Hospital, Portland, OR. Clinical Vestibular Lab.
ROLE OF SOMATOSENSORY AND VESTIBULAR CUES IN ATTENUATING VISUALLY INDUCED HUMAN POSTURAL SWAY
ROBERT J. PETERKA and MARTHA S. BENOLKEN 1993 32 p
(Contract(s)/Grant(s): NAG9-117; NAGW-3782; P60-DC-0207-02)
(NASA-CR-197845; NAS 1.26:197845) Avail: CASI HC A03/MF A01

The purpose was to determine the contribution of visual, vestibular, and somatosensory cues to the maintenance of stance in humans. Postural sway was induced by full field, sinusoidal visual surround rotations about an axis at the level of the ankle joints. The influences of vestibular and somatosensory cues were characterized by comparing postural sway in normal and bilateral vestibular absent subjects in conditions that provided either accurate or inaccurate somatosensory orientation information. In normal subjects, the amplitude of visually induced sway reached a saturation level as stimulus amplitude increased. The saturation amplitude decreased with increasing stimulus frequency. No saturation phenomena was observed in subjects with vestibular loss, implying that vestibular cues were responsible for the saturation phenomenon. For visually induced sways below the saturation level, the stimulus-response curves for both normal and vestibular loss subjects were nearly identical implying that (1) normal subjects were not using vestibular information to attenuate their visually induced sway, possibly because sway was below a vestibular-related threshold level, and (2) vestibular loss subjects did not utilize visual cues to a greater extent than normal subjects; that is, a fundamental change in visual system 'gain' was not used to compensate for a vestibular deficit. An unexpected finding was that the amplitude of body sway induced by visual surround motion could be almost three times greater than the amplitude of the visual stimulus in normals and vestibular loss subjects. This occurred in conditions where somatosensory cues were inaccurate and at low stimulus amplitudes. A control system model of visually induced postural sway was developed to explain this finding. For both subject groups, the amplitude of visually induced sway was smaller by a factor of about four in tests where somatosensory cues provided accurate versus inaccurate orientation information. This implied that (1) the vestibular loss subjects did not utilize somatosensory cues to a greater extent than normal subjects; that is, changes in somatosensory system 'gain' were not used to compensate for a vestibular deficit, and (2) the threshold for the use of vestibular cues in normals was apparently lower in test conditions where somatosensory cues were providing accurate orientation information. Author

N95-28176# Lawrence Livermore National Lab., Livermore, CA. The Intelligent Mechatronics and Machine Vision Lab.
LONG-RANGE EYE TRACKING: A FEASIBILITY STUDY
SURYA K. JAYAWEERA and SHIN-YEE LU 24 Aug. 1994 48 p Sponsored by the Small Business Program
(Contract(s)/Grant(s): W-7405-ENG-48)
(DE95-008587; UCRL-ID-118340) Avail: CASI HC A03/MF A01

The design considerations for a long-range Purkinje effects based video tracking system using current technology is presented. Past work, current experiments, and future directions are thoroughly discussed, with an emphasis on digital signal processing techniques and obstacles. It has been determined that while a robust, efficient, long-range, and noninvasive eye tracking system will be difficult to develop, such as a project is indeed feasible. DOE

N95-28253*# BBN Systems and Technologies Corp., Cambridge, MA.
PILOT OPINIONS ON HIGH LEVEL FLIGHT DECK AUTOMATION ISSUES: TOWARD THE DEVELOPMENT OF A DESIGN PHILOSOPHY
YVETTE J. TENNEY, WILLIAM H. ROGERS, and RICHARD W. PEW May 1995 111 p
(Contract(s)/Grant(s): NAS1-18788; RTOP 505-64-13-21)
(NASA-CR-4669; NAS 1.26:4669) Avail: CASI HC A06/MF A02

There has been much concern in recent years about the rapid increase in automation on commercial flight decks. The survey was composed of three major sections. The first section asked pilots to rate different automation components that exist on the latest commercial aircraft regarding their obtrusiveness and the attention and effort required in using them. The second section addressed general 'automation philosophy' issues. The third section focused on issues related to levels and amount of automation. The results indicate that pilots of advanced aircraft like their automation, use it, and would welcome more automation. However, they also believe that automation has many disadvantages, especially fully autonomous automation. They want their automation to be simple and reliable and to produce predictable results. The biggest needs for higher levels of automation were in pre-flight, communication, systems management, and task management functions, planning as well as response tasks, and high workload situations. There is an irony and a challenge in the implications of these findings. On the one hand pilots would like new automation to be simple and reliable, but they need it to support the most complex part of the job—managing and planning tasks in high workload situations. Author

N95-28676*# University of Southern California, Los Angeles, CA. Inst. of Safety and Systems Management.
THE EFFECTS OF CREW RESOURCE MANAGEMENT (CRM) TRAINING IN AIRLINE MAINTENANCE: RESULTS FOLLOWING THREE YEAR'S EXPERIENCE
J. C. TAYLOR and M. M. ROBERTSON Jun. 1995 74 p
(Contract(s)/Grant(s): NCC2-812)
(NASA-CR-196696; A-950067; NAS 1.26:196696) Avail: CASI HC A04/MF A01

An airline maintenance department undertook a CRM training program to change its safety and operating culture. In 2 1/2 years this airline trained 2200 management staff and salaried professionals. Participants completed attitude surveys immediately before and after the training, as well as two months, six months, and one year afterward. On-site interviews were conducted to test and confirm the survey results. Comparing managers' attitudes immediately after their training with their pretraining attitudes showed significant improvement for three attitudes. A fourth attitude, assertiveness, improved significantly above the pretraining levels two months after training. The expected effect of the training on all four attitude scales did not change significantly thereafter. Participants' self-reported behaviors and interview comments confirmed their shift from passive to more active behaviors over time. Safety, efficiency, and dependability performance were measured before the onset of the training and for some 30 months afterward. Associations with subsequent performance were strongest with positive attitudes about sharing command (participation), assertiveness, and stress management when those attitudes were measured 2 and 12 months after the training. The two month follow-up survey results were especially strong and indicate that active behaviors learned from the CRM training consolidate and strengthen in the months immediately following training. Author

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

A95-82463
A SLIDING MODE CONTROL FOR TWO-LINK FLEXIBLE MANIPULATOR
HIRONORI FUJII Tokyo Metropolitan Institute of Technology, Tokyo, Japan, KOHJI SUGAHARA Tokyo Metropolitan Institute of Technology, Tokyo, Japan, and KENJI UCHIYAMA Tokyo Metropolitan Institute of Technology, Tokyo, Japan *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 1125-1130
Copyright

This paper studies a control problem of manipulation of a flexible manipulator mounted on space structures. The controller is designed based on sliding mode control theory to control the manipulator to a desired position, suppressing the elastic deflection of the flexible manipulator. Elastic deflection of the link of the manipulator is controlled by only controlling its first mode of vibration. No process of the inertia matrix inversion is required for the present controller. The results of numerical simulation are presented to show that the controller works well for the present control problem of manipulation of a flexible manipulator. Author (Herner)

A95-82464
TRACKING CONTROL OF SPACE MANIPULATOR USING H-INFINITY THEORY
TSUTOMU MURAYAMA Tokyo Metropolitan Institute of Technology, Tokyo, Japan, SHIN-ICHI SAWADA Tokyo Metropolitan Institute of Technology, Tokyo, Japan, and HIRONORI FUJII Tokyo Metropolitan Institute of Technology, Tokyo, Japan *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 1131-1136
Copyright

In this paper, the H-infinity theory is applied to design a servo controller for space manipulators. The dynamics of system are linearized using a nonlinear compensator since the space manipulator system has significant nonlinearities in its dynamics. A numerical simulation follows the analysis, and some features of the control algorithm are discussed with regard to the performance of the present design. Author (Herner)

A95-82465
SPACE ROBOT TELEMANIPULATION EXPERIMENT USING PREDICTIVE DISPLAY
KOHTARO MATSUMOTO National Space Development Agency, Tokyo, Japan *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 1137-1142
Copyright

For space robot teleoperation, data transmission delay time and channel capacity between the robot on-orbit and the ground operation center are the essential factors in control. The predictive display has been proposed to reduce the effect of delay time. This paper will describe an experimental result of teleoperation under the transmission delay condition, using a relatively simple system. It will be shown that the predictive display approach will work well even for a large delay time and low command frequency using only the positioning commands. Also it will be shown that the effectiveness of the predictive display depends on task complexity.
Author (Herner)

A95-82466
ARM TRAJECTORY DESIGN OF A SPACE ROBOT
KATSUHIKO YAMADA Mitsubishi Electric Corporation, Hyogo, Japan and SHOJI YOSHIKAWA Mitsubishi Electric Corporation, Hyogo, Japan *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 1143-1150
Copyright

Attitude control of a space robot by the manipulator arm is considered in this paper. For the purpose, we give an effective algoritm to find the arm trajectory from the initial posture of the arm to the final posture identical with the initial one. We introduce a measure to evaluate the difficulty of attitude control during arm motion. A numerical study is done to examine the value of the measure for every direction of the attitude change. Numerical simulation is also used to verify that the desired attitude change is obtained by the proposed trajectory. Author (Herner)

A95-82467
PATH PLANNING OF SPACE MANIPULATOR USING MINIMAX OPTIMIZATION IN TIME DOMAIN
HIRONORI FUJII Tokyo Metropolitan Institute of Technology, Tokyo, Japan, MASAYUKI NAKAGAWA Tokyo Metropolitan Institute of Technology, Tokyo, Japan, and TSUTOMU MURAYAMA Tokyo Metropolitan Institute of Technology, Tokyo, Japan *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 1151-1156
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The path planning of a space manipulator is studied with the application of the minimax optimization approach, and the specific features of the present method are discussed. The approach is able to treat a generic nonlinear and/or time-variant system and constraints on control input. The minimum principle results in a necessary condition for the optimal control input and thus a two-point boundary-value problem associated with the minimax optimization.

The results of numerical simulation are shown, and the preferable performance of the present control method is confirmed.
Author (Herner)

A95-82468
TRAJECTORY PLANS AND MOTION CONTROL OF A SPACE ROBOT WITH TWO MANIPULATORS
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In International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 1157-1162

Trajectory plans and motion control of a space robot with two manipulators are studied by extending results of a single manipulator. The generalized Jacobian is derived, which describes coupling motions between the main body and two manipulators. The motion control is done by combining the optimal trajectory plans of the two manipulators and the generalized Jacobian. Using a performance index that consists of the final rotational angle of the main body and energy expended by the manipulators, optimal trajectories of the two manipulators are obtained for a simplified model. These optimal trajectories can significantly reduce the attitude motion of the main body affected by the movements of the manipulators. It is shown as well that, to suppress the attitude motion of the main body, there exists a specific movement of the one arm, while moving the other arm toward an aiming point. Author (Herner)

A95-82469
CONCEPT OF INTEGRATED MANIPULATOR, POWER AND ATTITUDE CONTROL TECHNOLOGY
OSAMU OKAMOTO National Aerospace Laboratory, Tokyo, Japan, TAKASHI KIDA National Aerospace Laboratory, Tokyo, Japan, ISAO YAMAGUCHI National Aerospace Laboratory, Tokyo, Japan, and YOSHIAKI OHKAMI Tokyo Institute of Technology, Tokyo, Japan
In International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 1163-1168

In future space missions, manipulators will often be installed in advanced spacecraft such as a platform or free flyer in order to reduce danger in risky operations and the workload of astronauts or ground operators. Interaction problems of the manipulator with other sub-systems such as power and thermal control systems have been overlooked, although the manipulator maneuver dissipates a large amount of power resulting in excessive thermal output. This paper proposes a concept called IMPACT (Integrated Manipulator, Power and Attitude Control Technology). The concept is that a control moment gyro (CMG) or momentum wheel is used not only as an attitude control system actuator but also as a power storage and exchange unit between the power control system and a manipulator system. By using a motor-generator for a manipulator hinge actuator, mechanical energy of a manipulator is changed to electric power and vice versa. Thus, heat generation of a manipulator caused by the mechanical damping/braking device can be reduced, and thermal disturbance to the thermal control system minimized. This paper describes the concept of IMPACT, with mathematical modeling of energy and momentum management. For illustration, simulation results are given for a simplified model. Author (Herner)

A95-82470
DEVELOPMENT OF AN AUTONOMOUS SPACE ROBOT FOR RETRIEVING A SATELLITE
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In International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 1169-1174

The authors developed a two dimensional operation testbed for an autonomous free-flying space robot such as an orbital maneuvering vehicle. This system has been named ASROT (autonomous space robot operation testbed). Basically, ASROT consists of a satellite robot, a target, a host computer and a planar base. The host computer is used only for observation and data gathering of the system. The satellite robot is a satellite which can establish various tasks with a manipulator. The satellite is 620 mm (W) x 805 mm(H) x 620 mm(L). Its weight is 120 kg. This system floats on a planar base using air pads, and is able to fly around using thrusters for position control and a control moment gyro for attitude control. The manipulator is a 1.4 m long arm. This paper proposes an operating system needed for real time autonomous control. The satellite robot installs hardware systems such as vision systems, board computers, image processing units, and software systems such as algorithms for path planning. Author (Herner)

A95-82471
SATELLITE RETRIEVING EXPERIMENT OF FREE FLYING TELEROBOT
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In International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 1175-1180

A ground experimental model of a free flying telerobot is developed. The employed algorithms are compensated linear control rule for navigation, cooperative control between manipulators and telerobot, local sensory feedback manipulator control near target, and impedance control for catching and handling a target. Through an example task in which the telerobot tried to retrieve a drifting satellite, the conceptual design of this model is proved to suit orbital servicing systems. Author (Herner)

A95-82507
CARBON DIOXIDE ADSORPTION CHARACTERISTICS OF SOLID AMINE
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In International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 1431-1438

As an aspect of CO2 removing and recovering technologies utilized in space, the solid amine adsorbent was developed. The experiments to evaluate the characteristics of this material were conducted using dry air. Results indicate a high adsorbing rate, 10 wt % for short period and 7 wt % for long period; also, 7 wt % of adsorbing rate can be expected for the operation at desorption temperature of 80 C. A high-accuracy thermobalance device called a thermogravimetric analyzer was utilized to measure the CO2 adsorption and desorption values of solid amine.
Author (Herner)

A95-82508
A STUDY ON METABOLISM FOR INCORPORATING PLANT GROWING SUBSYSTEM INTO CELSS MATERIAL RECYCLING SYSTEM
YASUHIRO TAKO National Aerospace Lab., Tokyo, Japan, MITSUO OGUCHI National Aerospace Lab., Tokyo, Japan, and KEIJI NITTA National Aerospace Lab., Tokyo, Japan *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 1439-1448

The Controlled Ecological Life Support System (CELSS) is an advanced life support system for manned space activity and aims at self-sufficient material circulatory utilization. In CELSS, a plant growing subsystem takes on the roles of food production, carbon dioxide removal, oxygen production, and water reclamation through transpiration. To obtain the higher plant's metabolic data, we constructed the special plant growth chamber which creates an artificial controlled closed environment, in which crops could be grown for a whole season, and by which gas metabolism and transpiration could be measured simultaneously. In this study, we carried out three experiments using this chamber. In the first experiment 9 rice plants grew for 50 days in the open type growth chamber and were transplanted into the closed chamber. Thereafter, they were grown for 53 days, and they ripened. In the second experiment 8 rice plants grew for 35 days and were transplanted into the closed chamber and grown for 78 days, and they ripened. The part's dry weight per total dry weight, namely the harvest index, was 22.5%. In the third experiment 4 rice plants were grown for 14 days and transplanted into the closed chamber and grown for 96 days, and they ripened. The harvest index was 29.9%, and the grain yield was 615g/sq m. In these experiments, the carbon dioxide exchange rate and transpiration rate were measured simultaneously. From these data, the cultivation area needed to support human life could be estimated.
Author (Herner)

A95-82510
AN APPLICATION AND EVALUATION OF A CATALYST FOR WASTE MANAGEMENT WET-OXIDIZATION PROCESS
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A ruthenium (Ru) catalyst on an alumina (Al2O3) carrier has been apllied to the Wet-Oxidization process. Products obtained are analyzed to evaluate the performance of the catalyst; in addition, chemical and physical properties of the catalyst are checked and reviewed. The results show that the selected noble metal is suitable for the oxidizing of organic carbon and nitrogen with high efficiency. The carrier, however, seems not applicable for long-term use under the severe pressure-temperature conditions of the oxidization.
Author (Herner)

A95-82610
THE EFFECTS OF FREEZING ON SELECTED EUROPEAN AND ASIAN FOODS PREPARED FOR INTERNATIONAL SPACE MISSIONS
S. M. AHMED Texas Southern Univ., Houston, TX, US and C. N. OKOLI Texas Southern Univ., Houston, TX, US *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 2089-2096

The purpose of this study was (1) to evaluate the physical effects of freezer storage on the shelf life of Selected European and Asian foods, and (2) to determine the acceptability of these foods for International Space Missions. Selected Japanese foods were freshly prepared and frozen. Recipes for each food item were standardized and modified. Out of a population group of 37 Japanese food items, a sample of 16 were prepared and subjected to a shelf-life study. The prepared samples, were vacuum packed with a dyno seal film and stored for three, six and nine month intervals at 10 F. A zero storage evaluation of the prepared food samples was conducted on the basis of appearance, color, odor, flavor and texture to validate results of a prior study used as a criteria for selecting the study samples. Food samples that were evaluated included entrees, soups, vegetables, salads, desserts and beverages. Each food sample was scored on a 9-point hedonic scale. The statistical analysis showed significant differences for each factor at 0.5 confidence level.
Author (Herner)

A95-82620
DEVELOPMENT OF CLEANBENCH FOR LIFE SCIENCE EXPERIMENTS IN JAPANESE EXPERIMENT MODULE
KIWAO SHIBUKAWA National Space Development Agency of Japan, Tokyo, Japan, KEIJI MURAKAMI National Space Development Agency of Japan, Tokyo, Japan, RON USAMI National Space Development Agency of Japan, Tokyo, Japan, SHIGEKI KONDO Hitachi, Ltd., Hitachi, Japan, MASAYOSHI SONOBE Hitachi, Ltd., Hitachi, Japan, RYUSUKE ABE Hitachi, Ltd., Hitachi, Japan, KATSUMI SAKAGUCHI Hitachi, Ltd., Hitachi, Japan, MASAMI ITO Hitachi, Ltd., Hitachi, Japan, YUSUKE TAKAGI Space Environment Utilization Center, Tokyo, Japan, AKIRA ASHIDA Space Environment Utilization Center, Tokyo, Japan et al. *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 2149-2154

The operation of life science experiments in a closed environment such as a space station requires a special work bench to prevent the biosamples and the operator from biohazards. The Japanese Experiment Module (JEM) will offer a general purpose cleanbench with one fourth of a double rack for life science experiments involving cell handling. The cleanbench has capabilities to maintain sterilized environment, support various sample handling operations, permit observation of samples with digitized microscopes, and support cell fusion experiments. For this purpose the cleanbench is equipped with a dissecting microscope, a phase-contrast microscope, micromanipulators and a cell fusion device. The working chamber is capable of controlling its temperature, cleanliness and sterilization.
Author (Herner)

A95-82675
WAVE-ABSORBING CONTROL FOR FLEXIBLE MANIPULATOR OF SPACE ROBOT
KAZUNARI NAKAJIMA Tokyo Metropolitan Inst. of Tech., Tokyo, Japan *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 2509-2514

The wave-absorbing control is applied in order to suppress vibration in the flexible manipulator of space robt. The vibration is inevitably excited on the flexible manipulator of space robot due to such manipulation as rotation. The model treated is a one-link manipulator with sensors and a torque actuator at its root. Control algorithms employed are both of the proportional-integral-derivative control and the wave-absorbing control types. The control response is analyzed through use of the numerical simulation, and the results show as the response the characteristics of the vibration in terms of propagating disturbances in the frequency domain and the time responses of attitude angle and the bending moment at the root of the manipulator.
Author (Herner)

A95-82676
TASK PLANNING OF TWO ROBOT ARMS BY LEARNING OF MACRO-OPERATORS
TAKEHIKO EGUCHI Univ. of Tokyo, Tokyo, Japan, SEIKOH SHIRASAKA Univ. of Tokyo, Tokyo, Japan, and TAMITO HOSOYAMADA Univ. of Tokyo, Tokyo, Japan *In* International

Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 2515-2522
Copyright

Task planning is a key element of space robot operation. In this paper, a machine learning approach utilizing macro-operator generation method is employed to reduce the computational load and a gap between the real world and the logic world in which the Task Planner treated is compensated by the hierarchical architecture. In our method, macro-operators are generated automatically during the process of exhaustively searching for an operator sequence to satisfy the goal. By learning such macro-operators and utilizing task planning, the time required for task planning can be reduced. The sequence is sent to the Task Executer and executed. On executing, it compensates the gap between two worlds by visual feedback. We applied this method to a block construction task by two robot arms. Our system is given some basic operators; it constructs the blocks placed on the table into a long pole with a prescribed order of colors. Given the information of initial state and the final goal, the Task Planner searches for an appropriate sequence of operators which can yield the goal state. The generated sequence is sent to the robots, which execute it. Laboratory experiments using actual robots and blocks has been performed, and the reduction of task planning time has been observed. Author (Herner)

A95-83702
OXYGEN LOSS IN BIOSPHERE 2
JEFFREY P. SEVERINGHAUS Lamont-Doherty Earth Observatory, Palisades, NY, US, WALLACE S. BROECKER Lamont-Doherty Earth Observatory, Palisades, NY, US, WILLIAM F. DEMPSTER Space Biospheres Ventures, Oracle, AZ, US, TABER MACCALLUM Space Biospheres Ventures, Oracle, AZ, US, and MARTIN WAHLEN Scripps Inst. of Oceanography, La Jolla, CA, US Earth in Space (ISSN 1040-3124) vol. 6, no. 6 February 1994 p. 12-14
(HTN-95-61119) Copyright

Oxygen in Biosphere 2, a closed-ecological-system experiment in Arizona, has declined during the first 16 months of closure from 21% to 14%, and this depletion is enough to cause health problems in the human occupants. Evidence that the O2 loss is caused by microbial respiration of the excessive amount of organic matter incorporated into the experiment's soils was discovered. It was also found that the respired CO2 is reacting with the structure's concrete to form calcium carbonate. Topics covered include the following: oxygen and carbon in Biosphere 2, excess calcium carbonate in Biosphere 2 concrete, carbon isotopic evidence, and other observations. Herner

A95-84791
BIOLOGICAL AND BIOTECHNOLOGICAL WASTE MANAGEMENT IN MATERIALS PROCESSING
ALCIDES G. RARAZ Colorado School of Mines, Golden, CO, US JOM (ISSN 1047-4838) vol. 47, no. 2 February 1995 p. 56-63
(HTN-95-20610) Copyright

Materials processing operations generate wastes with inorganic and organic pollutants. Microorganisms selectively precipitate elements and degrade organic compounds. Several mechanisms and techniques that can be used to exploit microbial systems in biological waste management are examined. Biotechnology may enhance the application of these biological systems.
Author (Herner)

A95-85334* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
AVIATION HUMAN FACTORS RESEARCH IN U.S. UNIVERSITIES: POTENTIAL CONTRIBUTIONS TO NATIONAL NEEDS
R. KEY DISMUKES NASA. Ames Research Center, Moffett Field, CA, US International Journal of Aviation Psychology (ISSN 1050-8414) vol. 4, no. 4 Spring p. 315-331
(HTN-95-92290) Copyright

University research can make vital contributions to national needs in aviation human factors (AHF). This article examines the types of expertise and facilities available in universities and explores how university capabilities complement the work of government laboratories. The AHF infrastructure is discussed and compared to other fields of applied research. Policy and funding issues are also examined. This study is based on a survey conducted by the author, which included site visits to several universities, telephone interviews with faculty members at other universities, and a search of the AHF research literature. Author (Herner)

A95-85335
INFORMATION PRESENTATION FOR EXPERT SYSTEMS IN FUTURE FIGHTER AIRCRAFT
MICA R. ENDSLEY Texas Tech University, Lubbock, TX, US and ESIN O. KIRIS Texas Tech University, Lubbock, TX, US International Journal of Aviation Psychology (ISSN 1050-8414) vol. 4, no. 4 Spring p. 333-348 Research sponsored by the Association of Aviation Psychologists
(HTN-95-92291) Copyright

Expert systems have been promoted as a means to reduce workload and provide improved decision support to pilots in advanced future aircraft. For these systems to be utilized effectively, a means of providing the recommendations of the system and information for assessing the quality of those recommendations must be provided in a manner that meets the stringent workload and time requirements of the cockpit. A research study was undertaken to determine interface guidelines for presenting information on expert-system recommendations in this context. Four methods of presenting expert-system confidence associated with recommendations were compared to each other and to a control condition in which no confidence information was presented. Significant differences between display conditions and between experts and novices were found in their use of system-confidence information. Recommendations are presented for conveying real-time information on the reasoning processes of expert systems in future cockpits.
Author (Herner)

A95-85925
TOWARD A PSYCHOPHYSICAL ASSESSMENT OF DYNAMIC CHANGES IN MENTAL WORKLOAD
DARRYL G. HUMPHREY University of Illinois at Urbana-Champaign, Champaign, Illinois, US and ARTHUR F. KRAMER University of Illinois at Urbana-Champaign, Champaign, Illinois, US Human Factors (ISSN 0018-7208) vol. 36, no. 1 March 1994 p. 3-26 Research sponsored by Office of Naval Technology
(HTN-95-B0109) Copyright

The main goal of the present study was to examine the feasibility of employing event-related brain pontentials (ERPs) to measure the dynamic changes in mental workload. Subjects performed two tasks, monitoring and mental arithmetic, both separately and together. Following an analysis of the performance, subjective workload ratings, and average ERP data in the single and dual-task conditions, two different conditions from each of the tasks were selected for further analysis. A bootstrapping approach was employed to determine the amount of ERP data required to discriminate between these conditions. The results of these analyses indicated that (a) 90% correct discrimination could be achieved with from 1 to 11 s of ERP data, (b) the best ERP measures varied across tasks and subjects, and (c) the inclusion of temporal and spatial aspects of the ERP data improved the ability to discriminate among workload levels. The data is discussed with respect to real-time assessment of mental workload. Author (revised by Herner)

A95-85927
IMPLICATIONS OF GRAPHICS ENHANCEMENTS FOR THE VISUALIZATION OF SCIENTIFIC DATA: DIMENSIONAL INTEGRALITY, STEROPSIS, MOTION AND MESH
CHRISTOPHER D. WICKENS University of Illinois at Urbana-Champaign, Savoy, Illinois, US, DAVID H. MERWIN University of Illinois at Urbana-Champaign, Savoy, Illinois, US, and EMILIE L. LIN University of Illinois at Urbana-Champaign, Savoy, Illinois, US

Human Factors (ISSN 0018-7208) vol. 36, no. 1 March 1994 p. 44-61
(Contract(s)/Grant(s): NSF IRI-90-21270)
(HTN-95-B0111) Copyright

This study examines the effectiveness of four techniques to assist scientists in evaluating multidemensional data. Subjects viewed a series of complex 3D data sets, each representing an underlying complex surface, from which a set of discrete points or observations were sampled. From each sample they answered questions that required focus of attention on certain data points or integration across varying numbers of data points and dimensions. After a number of samples were viewed from each surface, subjects were tested for their retention of the surface characteristics. In Experiment 1, 3D (perspective) representations were found to support superior performance to 2D (planar) representations, but only for more integrative questions. Animated motion provided no benefits. In Experiment 2, stereoptic views of a 3D display were also found to support performance, particularly for integrative questions, but the ability to rotate the data space (motion parallax) and the presence of a mesh surface connecting the points did not. The posttests revealed some evidence that 3D representations improved the ability to visualize the surface, but neither 3D renderings nor stereopsis led to a better abstract representation of the data. Author (Herner)

A95-85928* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
SIMULATION FIDELITY OF A VIRTUAL ENVIRONMENT DISPLAY
KENNETH NEMIRE NASA Ames Research Center, Moffett Field, California, US, RICHARD H. JACOBY Sterling Software,, and STEPHEN R. ELLIS NASA Ames Research Center, Moffett Field, California, US Human Factors (ISSN 0018-7208) vol. 36, no. 1 March 1994 p. 79-93
(Contract(s)/Grant(s): UPN-199-16-12-08; UPN-199-06-12-25)
(HTN-95-B0112) Copyright

We assessed the degree to which a virtual environment system produced a faithful simulation of three-dimensional space by investigating the influence of a pitched optic array on the perception of gravity-referenced eye level (GREL). We compared the results with those obtained in a physical environment. In a within-subjects factorial design, 12 subjects indicated GREL while viewing virtual three-dimensional arrays at different static orientations. A physical array biased GREL more than did a geometrically identical virtual pitched array. However, addition of two sets of orthogonal parallel lines (a grid) to the virtual pitched array resulted in as large a bias as that obtained with the physical pitched array. The increased bias was caused by longitudinal, but not the transverse, components of the grid. We discuss implications of our results for spatial orientation models and for designs of virtual displays. Author (Herner)

A95-85929* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
DESIGN OF A COOPERATIVE PROBLEM-SOLVING SYSTEM FOR EN-ROUTE FLIGHT PLANNING: AN EMPIRICAL EVALUATION
CHARLES LAYTON Galaxy Scientific Corporation, Atlanta, Georgia, US, PHILIP J. SMITH Ohio State University, Columbus, Ohio, US, and C. ELAINE MC COY Ohio University, Athens, Ohio, US Human Factors (ISSN 0018-7208) vol. 36, no. 1 March 1994 p. 94-119
(Contract(s)/Grant(s): NCC2-615; NCA2-701)
(HTN-95-B0113) Copyright

Both optimization techniques and expert systems technologies are popular approaches for developing tools to assist in complex problem-solving tasks. Because of the underlying complexity of many such tasks, however, the models of the world implicitly or explicitly embedded in such tools are often incomplete and the problem-solving methods fallible. The result can be 'brittleness' in situations that were not anticipated by the system designers. To deal with this weakness, it has been suggested that 'cooperative' rather than 'automated' problem-solving systems be designed. Such cooperative systems are proposed to explicitly enhance the collaboration of the person (or a group of people) and the computer system. This study evaluates the impact of alternative design concepts on the performance of 30 airline pilots interacting with such a cooperative system designed to support en-route flight planning. The results clearly demonstrate that different system design concepts can strongly influence the cognitive processes and resultant performances of users. Based on think-aloud protocols, cognitive models are proposed to account for how features of the computer system interacted with specific types of scenarios to influence exploration and decision making by the pilots. The results are then used to develop recommendations for guiding the design of cooperative systems. Author (Herner)

A95-85930* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
TELEOPERATOR PERFORMANCE WITH VARYING FORCE AND VISUAL FEEDBACK
MICHAEL J. MASSIMINO McDonnell Douglas Aerospace, Houston, Texas, US and THOMAS B. SHERIDAN Masachusetts Institute of Technology, Cambridge, Massachusetts, US Human Factors (ISSN 0018-7208) vol. 36, no. 1 March 1994 p. 145-157
(Contract(s)/Grant(s): NGT-50145; JPL-95-6892)
(HTN-95-B0114) Copyright

An experimental study was conducted to determine the effects of various forms of visual and force feedback on human performance for several 'peg-in-hole'-type telemanipulation tasks. Each of six human test subjects used a master/slave manipulator during two experimental sessions. In one session the subjects performed the tasks with direct vision, where subtended visual angle, force feedback, task difficulty, and the interaction of subtended visual angle and force feedback made signigicant differences in task completion times. During the other session the tasks were performed using a video monitor for visual feedback, and video frame rate, force feedback, task difficulty and the interaction of frame rate and force feedback were found to make significant differences in task times. An analysis between the direct and video viewing environments showed that apart from subtended visual angle and reduced frame rate, the video medium itself did not significantly affect task times relative to direct viewing. Author (Herner)

A95-85933
ODOR IDENTIFICATION BY NAME AND BY EDIBILITY: LIFE-SPAN DEVELOPMENT AND SAFETY
RENE A. DE WIJK John B. Pierce Laboratory, New Haven, Connecticut, US and WILLIAM S. CAIN John B. Pierce Laboratory, New Haven, Connecticut, US Human Factors (ISSN 0018-7208) vol. 36, no. 1 March 1994 p. 182-187
(Contract(s)/Grant(s): NIH-DC-00284; NIH-AG-04287)
(HTN-95-B0117) Copyright

The study explored how subjects from childhood (8-14 years old) to elderly adulthood could identify the odors of 17 everyday products. Performance at naming followed an inverted U-shaped course over age, best in young adults and poorest in children and elderly. A discrimination task given to the adults revealed parallel age-related declines in ability to name and to discriminate odors. Correct identification by edibility exceeded that by name considerably. For dangerous household products, children achieved only 15% correct naming but 79% correct edibility/inedibility. Scenting of dangerous household products, however, may compromise the discriminability of these products from less harmful ones. 'Fresh'-scented hypochlorite bleach yielded signifciantly more errors regarding its possible causticity than did unscented bleach. Such modifications of products would seem to necessitate other compensatory changes to enhance discriminability and thereby maintain safety. Author (Herner)

A95-86261
OBTAINING MEDICAL AND BIOLOGICAL IMAGES BY FTIR MULTIASPECT PROJECTION REFRACTOMETRY
V. N. MOROZOV Scientific Research Inst. of Optical Instrumenta-

tion, St. Petersburg, Russ and V. V. AGUREEV Scientific Research Inst. of Optical Instrumentation, St. Petersburg, Russ Journal of Optical Technology (ISSN 1070-9762) vol. 61, no. 12 December 1994 p. 868-870 Transl. of Opticheskii Zhurnal, vol. 61, no. 12, 1994, p. 24-26
(HTN-95-61162) Copyright

A new method of obtaining images is proposed, called frustrated total internal reflection (FTIR) multiaspect projection refractometry. A theoretical basis is provided for it, and its experimental implementation is described. Using this method to study a number of biological objects showed that it can be used to obtain high-contrast images of such objects. Author (Herner)

A95-86263
PRINCIPLES OF CONSTRUCTING AN EXPERT SYSTEM FOR MEDICAL THERMAL VISION

T. G. RAIGORODSKAYA S.I. Vavilov State Optical Inst., St. Petersburg, Russia Journal of Optical Technology (ISSN 1070-9762) vol. 61, no. 12 December 1994 p. 880-884 Transl. of Opticheskii Zhurnal, vol. 61, no. 12, 1994, p. 36-40
(HTN-95-61164) Copyright

This paper discusses the possible approaches for developing an expert system (ES) to carry out thermal-vision screening examinations of women's breast for the ES of the production type, with a detection of mammary-gland cancer. It is proposed to create an ES of the production type, with a direct-output mechanism. A knowledge base is constructed on the probability-statistical principle (with an a priori scoring evaluation of each variable). The ES consists of two modules. As a result of the examination, a conclusion is drawn as to which group (normal, doubtful, risk, high risk) the patient belongs. The main stages of the work being done in this direction are presented. Author (Herner)

A95-86265
FIBER-OPTIC LUMINESCENCE PROBES FOR BIOMEDICAL STUDIES

I. YA. BARSKII S.I. Valilov State Optical Inst., St. Petersburg, Russia and G. V. PAPAYAN S.I. Valilov State Optical Inst., St. Petersburg, Russia Journal of Optical Technology (ISSN 1070-9762) vol. 61, no. 12 December 1994 p. 905-908 Transl. of Opticheskii Zhurnal, vol. 61, no. 12, 1994, p. 60-63
(HTN-95-61166) Copyright

This paper describes two fiber-optic medical devices developed at the Scientific Research Institute of Optical Instrumentation of the S.I. Vavilov State Optical Institute and intended for the implementation of fluorometric and spectrofluorometric research techniques in the clinic and in experiments on animals: an intraoperation luminescence probe and a medical spectrofluorimeter. Examples are given of their use in medicine.
Author (Herner)

A95-86266
DIGITAL GLUCOSIMETER-POLARIMETER FOR MEASURING THE OPTICAL ACTIVITY OF SOLUTIONS

E. K. GALANOV S.I. Vavilov State Optical Inst., St. Petersburg, Russia, V. G. MEDVEDEV S.I. Vavilov State Optical Inst., St. Petersburg, Russia, A. V. IVANOV S.I. Vavilov State Optical Inst., St. Petersburg, Russia, and S. I. TSAR'KOVA S.I. Vavilov State Optical Inst., St. Petersburg, Russia Journal of Optical Technology (ISSN 1070-9762) vol. 61, no. 12 December 1994 p. 915-916 Transl. of Opticheskii Zhurnal, vol. 61, no. 12, 1994, p. 70-71
(HTN-95-61167) Copyright

A compact digital glucosimeter-polarimeter, the MD-129, has been developed and fabricated, whose operation is based on the modulation of the azimuth of the plane of polarization by means of an electromechanical modulator-polarizer and the comparison of the signals of the first and second harmonics. It is shown that the measurement error caused by displacing the lambda(sub max) of the device does not exceed 0.05% when the device is calibrated by means of quartz plates. The measurement error of the device is 0.1% (0.02 deg.), the measurement limits are 0-10% (+/- 5 deg.), the working region of the spectrum is lambda = 565 nm, the sample cell is 50 mm long, and the mass of the device is 6 kg.
Author (Herner)

A95-86267
METHODS AND APPARATUS FOR IN VITRO OPTICAL ACTION ON BLOOD

YU. V. POPOV S.I. Vavilov State Optical Inst., St. Petersburg, Russia, L. M. KUKUI S.I. Vavilov State Optical Inst., St. Petersburg, Russia, and O. G. SOROKINA S.I. Vavilov State Optical Inst., St. Petersburg, Russia Journal of Optical Technology (ISSN 1070-9762) vol. 61, no. 12 December 1994 p. 917-921 Transl. of Opticheskii Zhurnal, vol. 61, no. 12, 1994, p. 72-76
(HTN-95-61168) Copyright

This paper presents a description of methods and apparatus for optical action on blood outside the organism in a wide spectral range, from UV (lambda = 254 nm) to visible (lambda = 632.8 nm). Optical action on blood is effective not only for the treatment but also for the prophylaxis of a number of diseases in therapeutic, surgical, gynecological, infection, and other clinics, as well as for strengthening the action of intravenoulsy introduced drugs. The apparatus can be used not only under stationary conditions, but also under ambulatory conditions. It can be used in veterinary science for prophylaxis and treatment of large horned cattle, horses, sheep, swine, cats, and dogs. Author (Herner)

A95-86268
LASERS IN THE THREE-MICROMETER RANGE FOR MEDICAL APPLICATIONS

O. I. AVDEEV S.I. Vavilov State Optical Inst., St. Petersburg, Russia, A. V. DANILOV S.I. Vavilov State Optical Inst., St. Petersburg, Russia, E. E. DEVONIN S.I. Vavilov State Optical Inst., St. Petersburg, Russia, A. V. LUKIN S.I. Vavilov State Optical Inst., St. Petersburg, Russia, and V. V. LYUBCHENKO S.I. Vavilov State Optical Inst., St. Petersburg, Russia Journal of Optical Technology (ISSN 1070-9762) vol. 61, no. 12 December 1994 p. 922-923 Transl. of Opticheskii Zhurnal, vol. 61, no. 12, 1994, p. 77-78
(HTN-95-61169) Copyright

This paper discusses some aspects of the medical use of lasers in the three-micrometer region, operating in the free-lasing and Q-switched regimes. It is experimentally shown that radiation with a wavelength of 2.69 microns acts on biological objects with high efficiency. A laser is described that operates at a wavelength of 2.69 microns (two modifications) and is designed for clinical practice in medical institutions. Author (Herner)

A95-86269
COMPACT HOLOGRAPHIC APPARATUS FOR STOMATOLOGY

A. E. KOROLEV S.I. Vavilov State Optical Inst., St. Petersburg, Russia, A. L. CHURAEV S.I. Vavilov State Optical Inst., St. Petersburg, Russia, and M. F. SUKHAREV S.I. Vavilov State Optical Inst., St. Petersburg, Russia Journal of Optical Technology (ISSN 1070-9762) vol. 61, no. 12 December 1994 p. 924-927 Transl. of Opticheskii Zhurnal, vol. 61, no. 12, 1994, p. 79-82
(HTN-95-61170) Copyright

This paper presents the results of the development of a specialized compact holographic apparatus intended for the study and nondestructive testing of orthopedic stomatology components by holographic interferometry. This paper presents the results of specific studies on the apparatus as applied to the designs of dental protheses and their shape, as well as to the regularities of the stress and strain distribution around single implants. Author (Herner)

N95-26364*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
INTERNATIONAL SPACE STATION ALPHA TRACE CONTAMINANT CONTROL SUBASSEMBLY LIFE TEST REPORT Final Report
J. D. TATARA (ION Electronics, Hunsville, AL.) and J. L. PERRY Washington Mar. 1995 73 p
(NASA-TM-108488; NAS 1.15:108488) Avail: CASI HC A04/MF A01

The Environmental Control and Life Support System (ECLSS) Life Test Program (ELTP) began with Trace Contaminant Control Subassembly (TCCS) Life Testing on November 9, 1992, at 0745. The purpose of the test, as stated in the NASA document 'Requirements for Trace Contaminant Control Subassembly High Temperature Catalytic Oxidizer Life Testing (Revision A)' was to 'provide for the long duration operation of the ECLSS TCCS HTCO (High Temperature Catalytic Oxidizer) at normal operating conditions... (and thus)... to determine the useful life of ECLSS hardware for use on long duration manned space missions.' Specifically, the test was designed to demonstrate thermal stability of the HTCO catalyst. The report details TCCS stability throughout the test. Graphs are included to aid in evaluating trends and subsystem anomalies. The report summarizes activities through the final day of testing, January 17, 1995 (test day 762). Author

N95-26552 Institute for Defense Analyses, Alexandria, VA.
A MATHEMATICAL FRAMEWORK FOR AN IMPROVED SEARCH MODEL Final Report, Sep. 1993 - Apr. 1994
JEFFREY NICOLL Oct. 1994 103 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract(s)/Grant(s): DASW01-94-C-0054)
(AD-A288858; IDA-P-2901; IDA/HQ-93-44557) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

Search is currently modeled for DOD applications by a single exponential function. The two adjustable parameters are the time constant, t, characterizing the exponential; and the long time detection probability, P. Deficiencies of the classical model are: (1) human performance data cannot typically be fit with a single exponent model; (2) the probability of detection for short times is less than that predicted by the classical model; and (3) the effects of multiple targets and clutter can only be included by adjusting the two-model parameters, which is performed in an ad hoc manner and overconstrains the model. This paper introduces a neoclassical model that includes three processes: (1) attending to the target; (2) random wandering around the scene; and (3) attending to other targets/clutter. An expression involving three exponents associated with the three processes is derived and special cases are described. The new model provides uniform treatment of multiple targets and false detections and allows for the separate descriptions of multiple times scales within the search process. Searches can be separated into single region, field-of-view search, and multiple region, field-of-regard search. Field-of-view search can be further subdivided into long searches during which the observer may examine many targets and short searches which are completed after a few target examinations. DTIC

N95-26558 Army Research Inst. of Environmental Medicine, Natick, MA.
PERFORMANCE ENHANCING RATION COMPONENTS PROGRAM: SUPPLEMENTAL CARBOHYDRATE TEST
T. C. MURPHY, R. W. HOYT, T. E. JONES, C. L. GABAREE, E. W. ASKEW, T. A. SKIBINSKI, and M. L. BARKATE (Louisiana State Univ., Baton Rouge, LA.) 28 Jun. 1994 44 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(AD-A288560; USARIEM-T-2/95) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

The Performance Enhancing Ration Components (PERC) project supports the Army Science and Technology Objective 'Nutritional Strategies to Enhance Soldier Performance.' The focus of the PERC project is to demonstrate, through nutrition intervention, enhancement of physical and/or mental performance in extreme environmental conditions or during sustained high-intensity work. In this PERC study, we examined the effects of a liquid carbohydrate (CR0) supplement on exercise endurance of Special Operations Forces (SOF) soldiers. The results of this study have encouraging implications in that they demonstrate that the sustainability and survivability of our combat forces can be enhanced through nutrition intervention. By tailoring the nutrient composition of the diet, environmental and battlefield stress may be attenuated and decrements in performance may be prevented. DTIC

N95-26612 OGDEN/ERC Government Systems, Fairfax, VA.
US COAST GUARD HUMAN SYSTEMS INTEGRATION (HSI) PROCESS MODEL Final Report
WAYNE WRIGHT and RICHARD HALL Apr. 1994 222 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract(s)/Grant(s): MIPR-Z51100-2-E00416)
(AD-A289172; CGR/DC-11/94; CG-D-26-94) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

The Coast Guard has identified a need to improve Human System Integration (HSI) in the planning, design, and development of new system acquisitions. A previous effort, 'U.S. Coast Guard Human Systems Integration Program Requirements Document,' revealed that HSI principles are not consistently applied throughout the acquisition process, and that a formal HSI program would ensure that human related issues are addressed during new system acquisitions. This report provides a recommended 'Process Model' for integrating the various elements of HSI (i.e., Manpower, Personnel, Training, Human Factors Engineering, and Safety/Health Hazards) into all new Coast Guard hardware acquisitions, including ships, aircraft, and all equipment / systems / subsystems fielded through the acquisition program. An evaluation was conducted to assess the strengths and weaknesses of existing HSI programs and determine whether elements of existing programs could be used in the Coast Guard environment. Based on this review, a process model was developed to integrate HSI into the Coast Guard acquisition process. DTIC

N95-26736 Navy Clothing and Textile Research Facility, Natick, MA.
LIGHTWEIGHT COLD WEATHER UNDERWEAR INVESTIGATION Final Report, Aug. - Dec. 1992
TINA M. PHANEUF Oct. 1994 22 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(AD-A288506; NCTRF-204) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

The Navy Clothing and Textile Research Facility was tasked by the Marine Corps Systems Command to conduct testing of various types of lightweight cold weather underwear materials for physical and thermal characteristics. These tests were conducted in order to develop a Marine Corps standard for future product development. Based on test results, two fabrics were recommended as good candidates for use in lightweight cold weather underwear. DTIC

N95-26737 Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Engineering.
ENHANCED VISUAL USER INTERFACE SUPPORT FOR DOMAIN-ORIENTED APPLICATION COMPOSITION SYSTEMS Master's Thesis
RICHARD A. GUINTO Dec. 1994 122 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(AD-A289337; AFIT/GCS/ENG/94D-06) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

This research refined the functionality and usability of a previously developed visual interface for a domain-oriented application composition system. The refinements incorporated more sophisticated user interface design concepts to reduce user workload. User workload was reduced through window reordering, menu redesign, and Human Computer Interaction techniques such as; combining

repetitive procedures into single commands, reusing composition information whenever possible and deriving new information from existing information. The Software Refinery environment, including its visual interface tool INTERVISTA, was used to develop techniques for visualizing and manipulating objects contained in a formal knowledge base of objects. The interface was formally validated with digital logic-circuits, digital signal processing, event-driven logic-circuits, and cruise-missile domains. A comparative analysis of the application composition process with the previous visual interface was conducted to quantify the workload reduction realized by the new interface. Level of effort was measured as the number of user interactions (mouse or keyboard) required to compose an application. On average, application composition effort was reduced 34.0% for the test cases. DTIC

N95-26755 Conrad Technologies, Inc., King of Prussia, PA.
DEVELOPMENT OF INJURY PREVENTING HELMET SERVO-SUPPORT SYSTEM FOR HIGH PERFORMANCE AIRCRAFT Progress Report
DONALD F. DECLEENE 30 Dec. 1994 22 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract(s)/Grant(s): N00014-94-C-0179)
(AD-A289547) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

The technical objective of this program is the development of a support system for the aviator's helmet wherein the load created by the helmet and helmet mounted equipment is removed from the aviator's head and is transferred directly to the aviator's seat and airframe. The Support system, while supporting the helmet load, shall be powered and controlled to move with the aviator's head such that the helmet is retained on the aviator's head in a normal manner. The support system shall provide freedom of head movement and allow the aviator to easily control the movement of his/her head, his/her helmet and the helmet mounted equipment. The technical objective of this program is being undertaken in the form of a multi-task program as outlined in the proposal. The objectives of the individual tasks are presented below. DTIC

N95-26863 Aerospace Medical Research Labs., Wright-Patterson AFB, OH. Human Resources Directorate.
DESIGN CONSIDERATIONS FOR FRANKTALK: A DISTRIBUTED GROUP SUPPORT SYSTEM Interim Report, Jan. 1992 - Jun. 1993
KENNON J. MOEN, MICHAEL WOLFE, and ALAN R. HEMINGER Oct. 1994 25 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(AD-A289386; AL/HR-TP-1994-0023) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

This paper discusses design considerations for a prototype distributed group support system as well as an initial assessment of its demonstrated functionality. The system created enabled participants in a group process to interact with each other across time and distance. Pilot studies were performed to measure user acceptance and system effectiveness and usability. DTIC

N95-26883 Air Force Inst. of Tech., Wright-Patterson AFB, OH.
AN IMAGE QUALITY ANALYSIS OF ANVIS-6 NIGHT VISION GOGGLES M.S. Thesis
DEREK H. ABEL Dec. 1994 76 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(AD-A289398; AFIT/CI/CIA/94-146) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

This study was undertaken in an effort to relate ANVIS-6 Night Vision Goggle image quality to user performance. The purpose was to determine which of five image quality metrics best related to performance tasks. The image quality metrics examined Modulation Transfer Function Area (MTFA), Integrated Contrast Sensitivity (ICS), Square Root Integral (SQRI), Resolution, and Signal-to-Noise Ratio (SNR). The performance tasks were detection and recognition of targets under various levels of moon illumination. The metric that best related to target detection was SNR. The SNR results are consistent with visual psychophysics and SNR effects. The metric that best related to target recognition was Resolution. The resolution results are consistent with the position that recognition performance improves for suprathreshold targets as resolving power increases. DTIC

N95-26884* Carnegie-Mellon Univ., Pittsburgh, PA. Robotics Inst.
MULTI-AGENT PERCEPTION FOR HUMAN/ROBOT INTERACTION: A FRAMEWORK FOR INTUITIVE TRAJECTORY MODIFICATION Technical Report
RICHARD M. VOYLES, JR. and PRADEEP K. KHOSIA 15 Sep. 1994 25 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract(s)/Grant(s): NAG1-1075)
(AD-A289399; CMU-RI-TR-94-33) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

An application of distributed perception to a novel human/computer interface is presented. A multi-agent network has been applied to the task of modifying a robotic trajectory based on very sparse physical inputs from the user. The user conveys intentions by nudging the end effector, instrumented with a wrist force/torque sensor, in an intuitive manner. In response, each agent interprets these sparse inputs with the aid of a local, fuzzified, heuristic model of a particular parameter or trajectory shape. The agents then independently determine the confidence of their respective findings and distributed arbitration resolves the interpretation through voting. DTIC

N95-27046 Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Engineering.
MULTIPLE MODEL ADAPTIVE ESTIMATION AND HEAD MOTION TRACKING IN A VIRTUAL ENVIRONMENT: AN ENGINEERING APPROACH M.S. Thesis
JAMES E. RUSSELL Dec. 1994 195 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(AD-A289299; AFIT/GCS/ENG/94D-21) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

Software engineering tools and techniques were applied to design and implement an application that reduces lag typically present in virtual environment displays. The application was a Multiple Model Adaptive Estimator (MMAE), composed of three Kalman filters, that predicted head orientation one sample period into the future. The environment rendering software used these predictions to generate the environment display. Each of the filters in the MMAE was designed for a different assumed head motion type (benign, moderate, or heavy), which allowed the MMAE to adapt to changes in head movement characteristics. The use of Ada 9X as an implementation language for a virtual environment applications was also investigated. Ada 9X provides object-oriented features for design and development, and it also offers software engineering support that makes it preferable to C or C++ for the application developed. Two significant results were produced. The first is a performance baseline for the MMAE that can be used as a benchmark for future research in this area. The other is a performance-based comparison of equivalent Ada 9X and C++ graphics applications in which Ada 9X performance was practically identical to C++. This second result is somewhat surprising, and should be investigated further. DTIC

N95-27058 Coast Guard, Washington, DC. Research and Development Center.
CREW ADAPTATION EVALUATION OF THE NORWEGIAN CREW CONCEPT (NOROREW) Final Report
DONALD I. TEPAS (Work Systems Research, Mansfield Center, CT.) and ANTONIO B. CARVALHAIS Sep. 1994 69 p Prepared in cooperation with Work Systems Research, Mansfield Center, CT Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(AD-A288478; USCG-R/DC-27/94; USCG-D-23-94) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

This report documents an Operational Test and Evaluation (OT&E) effort conducted to assess the feasibility of replacing select traditional small boat station shore-side facilities with live-aboard vessels. The success of such a concept is dependent on the crews' ability to adapt and cope with around-the-clock operations from a restricted work and living environment. Survey and log forms were used to collect continuous data on human factors variables, at both a traditional small boat station and an experimental live-aboard concept station, to assess the impact of the live-aboard concept on crew safety and well-being. Results of this evaluation indicate that all human factors variables were well within acceptable limits. The evaluation did not reveal any significant adverse effects on crew members which would prevent the use of the live-aboard concept in Coast Guard small boat stations which are similar to the one in the study. However, it was emphasized that although the results are positive, they may not reflect the reactions of crews in other Coast Guard small boat station environments. DTIC

N95-27099 Army Research Lab., Aberdeen Proving Ground, MD.
GLOVED OPERATOR PERFORMANCE STUDY. THE EFFECTS OF HAND WEAR AND ELASTIC RESISTANCE OF A CONTROL DURING TRACKING PERFORMANCE Final Report
GLEN ANDERSON, JAN BERKHOUT, MICHAEL GRANAAS, and SRI CANAKAPALLI May 1994 64 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract(s)/Grant(s): DA PROJ. 1L1-62716-AH-70)
(AD-A289405; ARL-CR-143) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

This study was to test the effects of wearing gloves during tracking performance at different levels of elastic resistance in a control. Forty-eight undergraduate students served as subjects. Each group contained 16 subjects, one group for each level of control resistance. The control was a spring-centered displacement joystick with resistance settings of 0.12 and 1702. All subjects performed a compensatory tracking task both bare-handed and while wearing a leather and wool glove assembly. Results indicated that: (1) wearing gloves is detrimental to tracking performance for female subjects; (2) female subjects do not benefit from additional exposure to the task before performing the task with gloves as do male subjects; (3) high control resistance may have been beneficial for female subjects during the gloved condition; and (4) small handed female subjects do not perform as well as medium and large handed female subjects, nor as well as male subjects. DTIC

N95-27164*# Alabama Univ., Huntsville, AL. The K. E. Johnson Research Center.
MARSHALL SPACE FLIGHT CENTER SOLID WASTE CHARACTERIZATION AND RECYCLING IMPROVEMENT STUDY Final Report
MICHAEL H. ELEY, LAVONNE CREWS, BEN JOHNSTON, DAVID LEE, and JAMES COLEBAUGH Apr. 1995 192 p Original contains color illustrations
(Contract(s)/Grant(s): NAS8-38609)
(NASA-CR-196594; NAS 1.26:196594; JRC-95-02) Avail: CASI HC A09/MF A02; 7 functional color pages

The MSFC Facilities Office, which is responsible for disposing of all waste generated by MSFC, issued a delivery order to the University of Alabama in Huntsville (UAH) to characterize current MSFC waste streams and to evaluate their existing recycling program. The purpose of the study was to define the nature, quantity, and types of waste produced and to generate ideas for improving the present recycling program. Specifically, the following tasks were to be performed: Identify various surplus and waste materials—as identified by the Contracting Officer's Technical Representative (COTR)—by source, location, and type; Analyze MSFC's current methods for handling, storage, transport, and disposition of waste and surplussed materials; Determine the composition of various surplus and waste materials as to type and quantities from various sources and locations; Analyze different methods for the disposition of various surplus and waste materials, including quality, quantity, preparation, transport cost, and value; Study possible alternatives to current methods of handling, storage, transport, and disposition of surplus and waste materials to improve the quality and quantities recycled or sold and to reduce and minimize the quantities of surplus and waste material currently being disposed of or stored; Provide recommendations for source and centralized segregation and aggregation of materials for recycling and/or disposition; and The analysis could include identification and laboratory level evaluation of methods and/or equipment, including capital costs, operating costs, maintenance requirements, life cycle and return on investment for systems to support the waste reduction program mission. Derived from text

N95-27195 Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Logistics and Acquisition Management.
FACTORS IN HUMAN-COMPUTER INTERFACE DESIGN (A PILOT STUDY) M.S. Thesis
SUSAN STEWART Dec. 1994 205 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(AD-A288908; AFIT/GIR/LAR/94D-6) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

The DOD has budgeted over $9.8 billion for 1995 for information technology, yet many government office workers let their existing systems sit idle. This thesis explores why these computers are sitting idle. This researcher's initial hypothesis was that certain features of the human-computer interface can positively or negatively affect efficiency, retention, and satisfaction level of workers. Although some research is being done in this area, interfaces continue to be of poor quality, especially in the DOD, where long procurement cycles, forced purchases, and limited budgets result in out-of-date software. Intuitively most programmers know the human-computer interface impacts on a person's ability to learn, but to what degree? This study is designed to test four basic human-computer interface features: color, white space, verb tense, and parallelism. In addition, it is designed to test the interaction between visual and linguistic features, color and verb tense, as well as between white space and parallelism. DTIC

N95-27501*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
AUTOMATIC LOCKING KNEE BRACE JOINT Patent Application
BRUCE WEDDENDORF, inventor (to NASA) 17 Apr. 1995 17 p
(NASA-CASE-MFS-28997-1; NAS 1.71:MFS-28997-1; US-PATENT-APPL-SN-422961) Avail: CASI HC A03/MF A01

This invention is an apparatus for controlling the pivotal movement of a knee brace comprising a tang-and-clevis joint that has been uniquely modified. Both the tang and the clevis have a set of teeth that, when engaged, can lock the tang and the clevis together. In addition, the tang is biased away from the clevis. Consequently, when there is no axial force (i.e., body weight) on the tang, the tang is free to pivot within the clevis. However, when an axial force is exerted on the tang, the tang is pushed into the clevis, both sets of teeth engage, and the tang and the clevis lock together. NASA

N95-27696# Federal Aviation Administration, Washington, DC. Office of Aviation Medicine
HUMAN FACTORS IN AVIATION MAINTENANCE, PHASE 4 Progress Report, Apr. 1993 - Apr. 1994
WILLIAM T. SHEPHERD May 1995 176 p Prepared in cooperation with Galaxy Scientific Corp., Atlanta, GA
(Contract(s)/Grant(s): DTFA01-94-C-01013)
(DOT/FAA/AM-95/14) Avail: CASI HC A09/MF A02

The fourth phase of research on human factors in aviation maintenance continued to look at the human's role in the aviation maintenance system via investigations, demonstrations, and evaluations of the research program outputs. This report describes the field evaluation plan for the Performance Enhancement System, a computer-based tool designed to aid Aviation Safety Inspectors in

performing their oversight duties (Chapter 2). Chapter 3 describes the design of a computer-based workcard system. The report also discusses the development of an ergonomic audit program for visual inspection, which contains a method of choosing tasks to be audited, an audit checklist, and a computer program to evaluate check-list response against national and international standards (Chapter 4). Chapter 5 reports on an investigation of ergonomic factors that may cause increased inspector stress, fatigue, and workload, particularly in restrictive spaces that cause extreme postures. The continued development and expansion of the hypermedia information system is reported on in Chapter 6. Chapter 7 describes an investigation of individual differences in nondestructive inspection performance. Chapter 8 describes an investigation to determine the effect of an Intelligent Help Agent on the effectiveness of computer-based training. Chapter 9 reports on a joint CAA/FAA investigation of reliability in aircraft inspection in the United Kingdom and United States. Chapter 10 is a bibliographic overview of selected issues in designing computer-based training systems. Author

N95-28390 Army Natick Research and Development Command, MA.
EVALUATION OF LASER-PROTECTIVE EYEWEAR DYES IN UVEX LENSES Final Report, Mar. - Jun. 1992
LEONARD A. LEVASSEUR, JOSEPH F. ROACH, and KATHRYNE B. BRUBAKER Nov. 1994 20 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(AD-A290076; NATICK/TR-95/006) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

Twenty-seven lenses of various dye combinations were received for testing from Uvex Corp. A previous contract from Uvex for Natick had failed the 240-hour Weatherometer test and this study was to determine which dye or which combination of dyes was responsible for this degradation. Dyes from different suppliers were incorporated into Uvex polycarbonate lenses. These dyes were laser blocking dyes obtained from Gentex, Polaroid, Barnes, Steadfast and Epolin (a Uvex dye) and used in various combinations within the lenses. These lenses were evaluated for optical density, visual transmittance, laser saturation, and solarization. Some of the lenses were tested in the weatherometer only. DTIC

N95-28659 Selskapet for Industriell og Teknisk Forskning, Trondheim (Norway).
PLANNING, DESIGN AND CONSTRUCTION OF THE CAVERN ARENA: HEATING, VENTILATION AND AIR CONDITIONING
H. M. MATHISEN and D. W. LEE 29 Apr. 1994 8 p Prepared in cooperation with Hyundai Engineering and Construction
(PB95-196382; STF15-S94002) Avail: Issuing Activity (National Technical Information Service (NTIS))

This paper deals with problems connected with heating and ventilation of underground premises for public use. Some properties of rock and special problems connected with designing ventilation systems for underground spaces are first briefly discussed. The rest of the paper deals with design of ventilation and heating systems. The conclusion is that there are no large problems with heating and ventilation of underground premises, but there are still problems connected with, for instance, thermal properties of rock when water flows in the cracks. An optimum design demands better knowledge of these properties. NTIS

N95-28667 Army Aeromedical Research Lab., Fort Rucker, AL.
MANIKIN INTEGRATED DATA ACQUISITION SYSTEM (MIDAS) INITIAL MODIFICATIONS Final Report
NABIH M. ALEM, JAMES A. LEWIS, and ROBERT M. DILLARD Dec. 1994 36 p Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
(Contract(s)/Grant(s): DA PROJ. 301-62787-A-878)
(AD-A291662; USAARL-95-11) Avail: Issuing Activity (Defense Technical Information Center (DTIC))

A prototype manikin with internal data acquisition system (MIDAS) has been developed and received by the US Army Aeromedical Research Laboratory. In addition to a novel design of the spinal column and pelvis of the Hybrid III automotive manikin, the new MIDAS includes a built-in signal conditioning and acquisition electronics. This report documents the initial modifications to the manikin and includes a description of the external software (MIDAS 3.0) for control, communication, and posttest downloading and analysis of the data. DTIC

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SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

A95-82617
FORMATION OF ORGANIC COMPOUNDS IN SPACE BY COSMIC RADIATION
KENSEI KOBAYASHI Yokohama National Univ., Yokohama, Japan, TAKESHI SAITO Univ. of Tokyo, Tokyo, Japan, JUNPEI KOIKE Tokyo Inst. of Tech., Yokohama, Japan, TAIRO OSHIMA Tokyo Inst. of Tech., Yokohama, Japan, TETSUO YAMAMOTO Inst. of Space and Astronautical Science, Sagamihara, Japan, TAKEO KANEKO Yokohama National Univ., Yokohama, Japan, and MASAHIKO TSUCHIYA Yokohama National Univ., Yokohama, Japan *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 2131-2136 Research sponsored by the Inst. of Space and Astronautical Science
(Contract(s)/Grant(s): MOESC-03854066)
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Gas mixtures simulating planetary atmospheres were irradiated with high energy protons (predominant components of cosmic rays), and organic compounds, including amino acids in the products, were analyzed. Gas mixtures used as starting materials were: carbon monoxide, nitrogen and water (primitive earth), carbon monoxide, ammonia and water (cometary coma), methane and ammonia (Jupiter), and methane and nitrogen (Titan). When each gas mixture was irradiated with 2.8 - 40 MeV protons generated with accelerators, various kinds of amino acids were detected in the hydrolyzed products. The yield of glycine (a major amino acid) was directly proportional to the energy deposit to the gas mixture when the same kind of the starting gas mixture was used. When a (14:14:1) gas mixture of carbon monoxide, nitrogen and water was irradiated with protons, the G-value of glycine in the hydrolyzed product was 0.02. The present results suggest that amino acids can be formed not only in various planetary atmospheres but also in interstellar space since carbon monoxide, nitrogen, water and cosmic rays are universal matters in space. Author (Herner)

A95-82618
CONSIDERATIONS OF EXTRATERRESTERIAL LIFE
AKIRA ASHIDA Hitachi, Ltd., Tokyo, Japan and JUNPEI KOIKE Tokyo Inst. of Tech., Yokohama, Japan *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 2137-2141
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By applying Drake's Equation to the extraterrestrial intelligence, including Earth, the equation gives more than one solution, which shows positive relationships among parameters. The number of the technological civilizations depends strongly on the period of the technological civilization. Namely, the existence ratio of the technological civilization world nearly equals to the inverse number of the stars. It is likely that this fact, however, does not always show the ease of finding extraterretrial life, because the only earth-type intelligent life, could be borne in the special biogeochemical history of earth. Silicon-based life is discussed as the possibility of another type of life. Robots as silicon-based life are discussed in comparison with the carbon-based earth type. The silicon type is alive in a wide

range of environments such as vacuum and cosmic ray fields. A candidate method for actively searching for extraterrestrials is to use probing spacecrafts with robotic technology. Author (Herner)

A95-82619
DEVELOPMENT OF CELL CULTURE FACILITY AS JEM GENERIC EXPERIMENT EQUIPMENT
KIWAO SHIBUKAWA National Space Development Agency of Japan, Tokyo, Japan, RON USAMI National Space Development Agency of Japan, Tokyo, Japan, KEIJI MURAKAMI National Space Development Agency of Japan, Tokyo, Japan, MASAKI KATOH Mitsubishi Heavy Industries Ltd., Kobe, Japan, MUNEO TAKAOKI Mitsubishi Heavy Industries Ltd., Kobe, Japan, and KAZUHIDE KAMIMURA Mitsubishi Heavy Industries Ltd., Kobe, Japan *In* International Symposium on Space Technology and Science, 18th, Kagoshima, Japan, May 17-22, 1992. Vols. 1 & 2. A95-82299 Tokyo, Japan ISTS Editorial Board 1992 p. 2143-2148

We have been developing the Cell Culture Facility (CCF) for Japanese Experiment Module (JEM) experiment equipment. The missions were analyzed to define the design requirements for the CCF based on the Design Reference Mission. The conceptual design was established; a new idea about the culture chamber was suggested. At the present time the feasibility test has been conducted on the culture chambers and related monitoring systems which are the key components. This paper describes the details and the present state of the development of CCF. Author (Herner)

A95-83716
LABORATORY STUDIES OF ORGANIC CHEMISTRY IN PLANETARY ATMOSPHERES: FROM SIMULATION EXPRIMENTS TO SPECTROSCOPIC DETERMINATIONS
PAUL BRUSTON Univ. Paris, Paris, France, M. KHLIFI Univ. Paris, Paris, France, Y. BENILAN Univ. Paris, Paris, France, and F. RAULIN Univ. Paris, Paris, France Journal of Geophysical Research (ISSN 0148-0227) vol. 99, no. E9 September 25, 1994 p. 19,047-19,061
(HTN-95-81363)

Possible approaches to the study of organic chemistry in planetary atmospheres are therefold: they comprise theoretical modeling, simulation experiments, and observational programs. Because of their respective merits and limitations, these approaches are quite complementary, and their simultaneous improvement is the way to progress further in the field. All three ask for laboratory work, and the lack, or limited accuracy, of laboratory data is the main restriction to future improvement. Together with the development of theoretical modeling (based on chemical kinetics and depending on laboratory studies of reaction pathways and rate constants) laboratory simulation remains a powerful technique. Despite the inaccurate reproduction of all planetary conditions, this experimental approach yields precious information on the nature of middle and higher order molecular weight organics that can be expected in an atmosphere of a given overall composition; and there is, in general, good agreement between the data obtained from simulations and those derived from observations. Indeed, several of the organic species highlighted in such experiments, and their relative abundances, are compatible with those detected in related planetary atmospheres. This is shown in the particular case of Titan. Thus experimental results furnish information on the nature of organics to be searched for in planetary atmospheres, while, in turn, the detection of such candidates and possible indications of their concentration profiles, or the setting of upper limits to their abundancies, constrain the kinetic approach. Given the lists of candidates from simulation experiments, experimental programs for a systematic determination of spectroscopic characteristics, including frequencies and band or line intensities, of the likely organics in planetary atmospheres, have to be developed. As an example, experimental requirements and current results, both in the IR and the UV range, are presented concerning Titan's atmosphere in view of the Cassin--Huygens mission. Author (Herner)

A95-83983
BIOLOGICAL RESPONSES TO SPACE: RESULTS OF THE EXPERIMENT 'EXOBIOLOGICAL UNIT' OF ERA ON EURECA I
G. HORNECK Institut fuer Luft- and Raumfahrtmedizin, Koln, Germany, U. ESCHWEILER Institut fuer Luft- and Raumfahrtmedizin, Koln, Germany, G. REITZ Institut fuer Luft- and Raumfahrtmedizin, Koln, Germany, J. WEHNER Institut fuer Luft- and Raumfahrtmedizin, Koln, Germany, R. WILLIMEK Institut fuer Luft- and Raumfahrtmedizin, Koln, Germany, and K. STRAUCH Institut fuer Luft- and Raumfahrtmedizin, Koln, Germany EURECA scientific results; Proceedings of F1 Symposium of the COSPAR Scientific Assembly, 13th, Hamburg, Germany, 11-21 July, 1994. A95-83964 Advances in Space Research (ISSN 0273-1177) vol. 16, no. 8 1995 p. (8)105-(8)118

Spores of different strains of Bacillus subtilis and the Escherichia coli plasmid pUC19 were exposed to selected conditions of space (space vacuum and/or defined wavebands and intensities of solar ultraviolet radiation) in the experiment ER 161 'Exobiological Unit' of the Exobiology Radiation Assembly (ERA) on board of the European Retrievable Carrier (EURECA). After the approximately 11 month duration of the mission, their responses were studied in terms of survival, mutagenesis in the his (B. subtilis) or lac locus (pUC19), induction of DNA strand breaks, efficiency of DNA repair systems, and the role of external protective agents. The data were compared with those of a simultaneously running ground control experiment. The survival of spores treated with the vacuum of space, however shielded against solar radiation, is substantially increased, if they are exposed in multilayers and/or in the presence of glucose as protective, whereas all spores in 'artificial meteorites', i.e. embedded in clays or simulated Martian soil, are killed. Vacuum treatment leads to an increase of mutation frequency in spores, but not in plasmid DNA. Extraterrestrial solar ultraviolet radiation is mutagenic, induces strand breaks in the DNA and reduces survival substantially; however, even at the highest fluences, i.e. 3 x 10(exp 8) Jm(exp -2), a small but significant fraction of spores survives the insolation. Action spectroscopy confirms results of previous space experiments of a synergistic action of space vacuum and solar UV radiation with DNA being the critical target. Author (Herner)

A95-83984
ERA-EXPERIMENT 'SPACE BIOCHEMISTRY'
K. DOSE Johannes Gutenberg-Universitat, Mainz, Germany, A. BIEGER-DOSE Johannes Gutenberg-Universitat, Mainz, Germany, R. DILLMANN Johannes Gutenberg-Universitat, Mainz, Germany, M. GILL Johannes Gutenberg-Universitat, Mainz, Germany, O. KERZ Johannes Gutenberg-Universitat, Mainz, Germany, A. KLEIN Johannes Gutenberg-Universitat, Mainz, Germany, H. MEINERT Johannes Gutenberg-Universitat, Mainz, Germany, T. NAWROTH Johannes Gutenberg-Universitat, Mainz, Germany, S. RISI Johannes Gutenberg-Universitat, Mainz, Germany, and C. STRIDDE Johannes Gutenberg-Universitat, Mainz, Germany EURECA scientific results; Proceedings of F1 Symposium of the COSPAR Scientific Assembly, 13th, Hamburg, Germany, 11-21 July, 1994. A95-83964 Advances in Space Research (ISSN 0273-1177) vol. 16, no. 8 1995 p. (8)119-(8)129 Research sponsored by BMFT and DARA

The general goal of the experiment was to study the response of anhydrobiotic (metabolically dormant) microorganisms (spores of Bacillus subtilis, cells of Deinococcus radiodurans, conidia of Aspergillus species) and cellular constituents (plasmid DNA, proteins, purple membranes, amino acids, urea) to the extremely dehydrating conditions of open space, in some cases in combination with irradiation by solar UV-light. Methods of investigation included viability tests, analysis of DNA damages (strand breaks, DNA-protein cross-links) and analysis of chemical effects by spectroscopic, electrophoretic and chromatographic methods. The decrease in viability of the microorganisms was as expected from simulation experiments in the laboratory. Accordingly, it could be correlated

with the increase in DNA damages. The purple membranes, amino acids and urea were not measurably effected by the dehydrating condition of open space (in the dark). Plasmid DNA, however, suffered a significant amount of strand breaks under these conditions. The response of these biomolecules to high fluences of short wavelength solar UV-light is very complex. Only a brief survey can be given in this paper. The data on the relatively good survival of some of the microorganisms call for strict observance of COSPAR Planetary Protection Regulations during interplanetary space missions. Author (Herner)

A95-85015
NUMERICAL SIMULATION OF ORGANIC COMPOUNDS FORMATION IN PLANETARY ATMOSPHERES: COMPARISON WITH LABORATORY EXPERIMENTS

M. DOBRIJEVIC Observatoire de Bordeaux, Floirac, France and J. P. PARISOT Observatoire de Bordeaux, Floirac, France Laboratory planetology; Symposium B2 of the COSPAR Scientific Assembly, 30th, Hamburg, Germany, July 11-21, 1994. A95-85014 Advances in Space Research (ISSN 0273-1177) vol. 15, no. 10 1995 p. 1-4

A numerical model of CH4 and CH4-NH3 photochemistry at 147 nm has been developed and results are directly compared with experimental simulations carried out for the same mixtures. Simulations with varying quantities of ammonia and hydrogen show how amines and nitriles can be produced in planetary atmospheres. These comparisons allow one to test schemes of reactions used in photochemical models. In particular, it is shown that the scheme of reactions of CH4 is fairly well consistent with experimental data. On the other hand, the photochemistry of NH3 should be improved.
Author (Herner)

A95-85016
THERMALLY UNSTABLE POLYYNES AND N-ORGANICS OF PLANETOLOGICAL INTEREST: NEW LABORATORY DATA AND IMPLICATIONS FOR THEIR DETECTION BY IN SITU AND REMOTE SENSING TECHNIQUES

A. AFLALAYE LISA, France, D. ANDRIEUX LISA, France, Y. BENILAN LISA, France, P. BRUSTON LISA, France, P. COLL LISA, France, D. COSCIA LISA, France, M. C. GAZEAU LISA, France, M. KHLIFI LISA, France, P. PAILLOUS LISA, France, R STERNBERG LISA, France et al. Laboratory planetology; Symposium B2 of the COSPAR Scientific Assembly, 30th, Hamburg, Germany, July 11-21, 1994. A95-85014 Advances in Space Research (ISSN 0273-1177) vol. 15, no. 10 1995 p. 5-11 Research sponsored by CNES and PNP

In the frame of a laboratory program on organic compounds of planetological interest only stable at low temperatures, we are currently studying the gas chromatographic (GC) and mass spectrometric (MS) behavior of gaseous polyynes and N-organics, together with their UV and IR spectra. We report here new experimental data on triacetylene (C6H2) expected to be present in Titan's atmosphere and dicyanoacetylene (C4N2), already detected in this environment. The GC-MS behavior of these compounds has been studied using fused silica wall coated open capillary column and Ion trap mass spectrometer. Quantitative GC-MS analysis is possible if the chromatograhic conditions use room temperature, fast separation (less than about 20 minutes) and low partial pressure of these unstable compounds. The limit of detectability of C4N2 by GC-MS analysis is 500 pg, about 50 times higher than that of C6H2. The UV and IR spectra of these compounds, which were only partially available in the literature, have been studied, including at low temperature. The strength of the main signatures (UV absorption coefficients and IR integrated intensities) have been systematically determined. In particular, we report the first quantitative spectroscopic data for C6H2. Such combined experimental studies avoid the risk of wrong diagnostics due to possible chemical contamination. The application of these techniques for searching for these organics in planetary atmospheres is also discussed.
Author (Herner)

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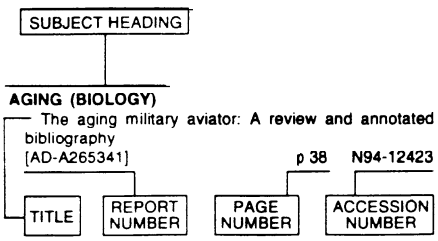

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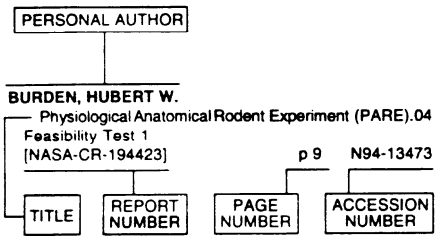

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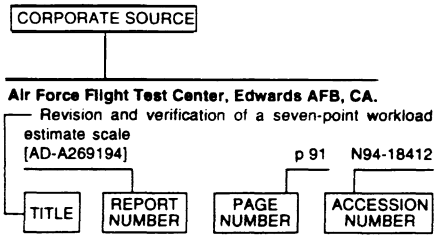

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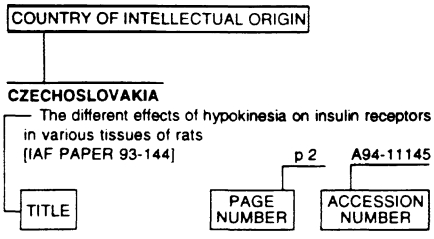

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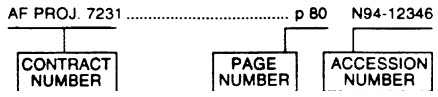

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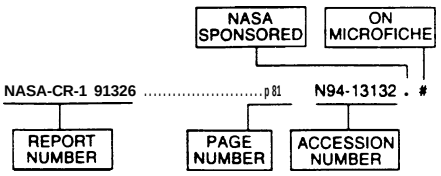

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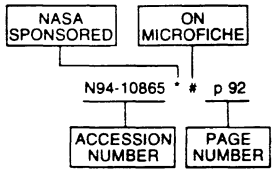

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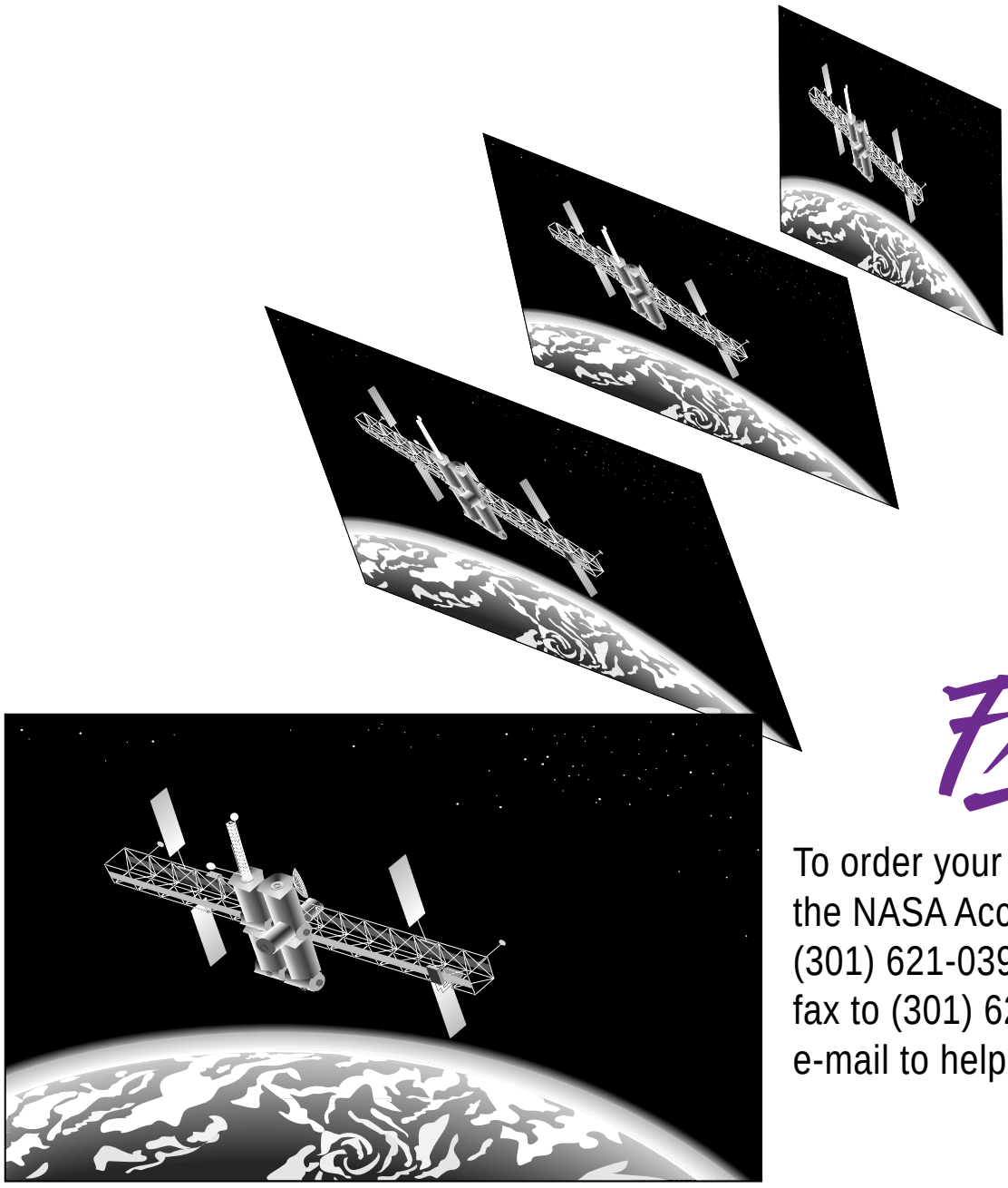

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